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Aug. 15, 1950

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BIOLOGY AND MEDICINE

4422 Decrease in the Sulfhydryl Content of Rat Plasma Following X-irradiation. Bernard Shacter and M. C. Fishler. Naval Radiological Defense Laboratory Interim Report No. AD-214(B), Apr. 26, 1950. 10p.

Exposure of rats to 750 r total body x-radiation is followed after several days by a marked decrease in the sulfhydryl content of the blood plasma. (auth)

4423 Action of Fast Electrons on Human Skin. Richard Kurt Kepp. Strahlentherapie 81, 201-14(1950) (in German).

A comparative study of the effects produced on human skin by hard x-rays and by fast electrons from the betatron of the Siemens-Reiniger plant is described. Fields on the thigh were irradiated with equal surface doses of the two radiations. Unlike the reaction produced by x-rays, that due to electrons is characterized by a rapid development, a high intensity, and a fast healing. Although x-rays produced no exudative reactions, the latter were often quite strong after fast-electron irradiations, and ended with a formation of thick crusts. Even in the case of very strong reactions, the healing took place within three weeks after the beginning of the exudative process. The intensity of reactions produced by electronic radiations grew with the dose, with the energy of the electrons, and with the dose rate (ratio r/min). This dependence of the skin reaction on the dose rate may prove very significant in the therapeutic applications of fast-electron beams. The considerably stronger effect of the latter on the skin, as compared with the action of x-rays, is explained by surmising a gradual increase of the dose under the surface of the skin, which concentrates the main effect in those tissue layers that are responsible for the skin reaction. (auth)

4424 The Action of Plesioroentgen Rays on M. Pyogenes Aureus. C. Gastaldi. Giorn. batteriol. immunol. 40, 257-280(1949)(in Italian).

Cultures of M. pyogenes aureus on agar were irradiated with plesioroentgen rays at 40 to 50 kv and at a distance of 1 to 2 mm, with no filters. The radiations may destroy the bacteria to a considerable extent, particularly if a high dose of irradiation is given (2,000 to 5,000 r). Doses of 400 to 500 r, however, cause a noticeable inhibiting action on the bacterial growth. The oldest bacteria show the greatest susceptibility to the radiation; the younger ones often survive.

4425 Arrest of Development of Plasmodium gallinaceum in Mosquitoes (Aedes aegypti) by Radiation Effect of P^{32}. P. F. Hahn, Victor H. Haas, and Aimee Wilcox. Science 111, 657-8(1950) June 16.

A total of 250 Aedes aegypti mosquitoes were allowed to engorge on chicks which were infected with Plasmodium gallinaceum and that showed many gametocytes in their peripheral blood. Thereafter 150 of the mosquitoes were provided daily with 5% glucose solution containing radioactive sodium acid phosphate (with a total radioactivity of about 30 mc of P^{32}). The remaining mosquitoes served as controls and were provided with nonradioactive glucose solution. Nine days following the blood feeding, ten mosquitoes from each group were dissected for determination

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of the presence of oocysts in their stomachs; all ten of the irradiated specimens contained oocysts, as did eight of the controls. Five days later, mosquitoes from the two groups were dissected and no sporozoites were found in the salivary glands of the irradiated specimens, but 11 out of the 15 control specimens showed these forms. The lowest activity for any salivary gland in the specimens administered the P^{32} solution was 334 cpm, while the average was 2,400 cpm; calculations suggest a very high equivalent roentgen dosage was delivered to the salivary gland tissue, despite the apparent absence of any deleterious effects. The author concludes that the radiation delivered by the ingested P^{32} was sufficient to arrest the development of the parasites during the oocyst stage.

4426 Atrophy of the Gastric Glands Produced by Beta Rays; Histological Findings in Animals. D. M. Douglas, W. R. Ghent, and S. Rowlands. The Lancet 1, 1035-8(1950) June 3.

The stomachs of four dogs were exposed to β-rays from an intragastric balloon in which was incorporated a layer of latex containing P^{32}; exposure times were 5 to 9 hr, depending on the activity of the P^{32} and the size of the stomach, and regulated so as to deliver about 5,000 r to the gastric mucosa. Biopsy specimens of gastric mucosa were taken at intervals from 39 to 74 days after irradiation. Various degrees of atrophy of the gastric glands were produced, but the underlying submucosa and muscularis were histologically normal.

4427 Changes in the Root Growth of Barley Seedlings Produced by Fast Electrons of a 6-Mev Betatron. K. H. Bruns, W. Dittrich, W. Paul, and G. Schubert. Strahlentherapie 81, 173-6(1950)(in German).

The action of fast electrons (from a 6-Mev betatron) on the growth of roots of barley seedlings was compared with that of x-rays, the dose range being 1,000 to 6,000 r. The radiobiological action was measured by the percentage decrease of the rate of growth of irradiated roots, as reflected in the root lengths 80 hr after the irradiation. A statistical treatment of the results revealed a weaker action of fast electrons as compared with that of x-rays. (auth)

4428 Chromosome Modifications Produced in Barley Seedlings by Fast Electrons of a 6-Mev Betatron. H. J. Schmermund, H. Bleck, and H. L. Heinrich. Strahlentherapie 81, 177-86(1950)(in German).

A comparative study was made of fast electrons and x-rays as radiobiological agents. Various doses of 4-Mev electrons obtained in a 6-Mev betatron, and of x-rays whose half-value layer was 0.25 mm Cu, produced changes in the mitosis pictures of the end cells in the roots of barley seedlings. These changes are fragmentations of the chromosomes plus a sticking together of the latter to form a bridge between the two chromatin masses of the dividing nucleus in its ana- and telo-phases. The frequency of such changes among the dividing cells was taken as a measure of the extent of the lesion produced by the irradiation. It was found that with both kinds of rays the structural changes grow with the dose, the fast electrons being somewhat less active, per dose unit, than x-rays. This difference is explained by the inequalities in the differential ionization and

in the size of the ion groupings produced by the two kinds of rays. If the ion groupings are considered the "hits" or "events" of the target theory of ray action, the lesion curves for both kinds of rays show that the number of "hits" involved in the reaction studied here is 3 to 5. (auth)

4429 A Comparative Study of the Action of Fast Electrons and X-rays on the Cornea of Salamander Larvae. H. Czech, R. Czech, and H. J. Schmermund. Strahlentherapie 81, 187-92(1950)(in German).

The cornea of the salamander larva was used for a comparative study of the radiobiological action of fast electrons and x-rays. The phenomenon observed was the so-called primary effect of a radiation on the mitotic division of cells. If a cell is irradiated while undergoing division, the effect produced by the irradiation is a primary effect, as distinguished from a secondary one produced by irradiating a cell in the resting stage. No qualitative differences in the disturbances produced by the two kinds of rays were observed. However, the frequency of pathologic changes in the mitosis due to the action of electrons was, per unit dose, lower than that corresponding to the action of x-rays. These findings are in agreement with the requirements of the "event" or "target" theory of the action of energetic radiations on biological structures. (auth)

4430 Damage of the Cell Nucleus by X-radiation. H. Marquardt. Experientia 5, 31-43(1949).

The aberrations produced in the cell nucleus by x-radiation are reviewed and classified; the primary and secondary effects of x-radiation of Bellevalia romana are described and illustrated. The primary effects, which occur when dividing nuclei are irradiated, include the retardation of nuclear cytoplasmic divisions, a change in the surface of the chromosomes and chromatidia (stickiness, pycnosis), anomalies of the spindles and chromatidia, and a modification of the staining reaction of the nuclei. The secondary effects, produced when resting nuclei are irradiated, include fragmentation (breaking of the chromosomes) and restitution (reconstitution of the chromosomes). The various methods of restitution are discussed in detail. A brief discussion of the hypotheses of x-ray-induced aberrations includes Lea's original hit hypothesis, Marquardt's modification of the former, and Darlington's chemical hypothesis (based on the disturbance of nucleic acid metabolism).

4431 Differences in the Biological Action of Ordinary and Ultra-Hard Radiations. F. Wachsmann. Strahlentherapie 81, 273-80(1950)(in German).

The biological effects of the new radiations furnished by the betatron (ultra-hard x-rays and fast electrons) must differ from those produced by ordinary x-rays, owing both to the more favorable dose distribution in space and to the lower ionization density of the new rays. Furthermore, the differences in the biological action are not just quantitative. Since the ratio of the responses to irradiations of both kinds of rays varies with different irradiated objects, it is permissible to expect a certain "selectivity." A few examples from the author's studies illustrate the point. It can be concluded from the shape of the survival curves of irradiated tadpoles that the biological structures attacked are not the same for the two kinds of radiation. Again, the different

ways in which the reticulocyte rate in mice is affected by the radiations point to differences in the mechanism of attack. Finally, tumors inoculated in mice and rats, when treated with 5-Mev electrons, show more satisfactory regression pictures and less deterioration of healthy tissues than in the case of a 200-kv x-ray treatment. (auth)

4432 Differential Radiosensitivity of Haploid and Diploid Prepupae and Pupae of Habrobracon. A. M. Clark and E. M. Kelly. Cancer Research 10, 348-52(1950) June.

Habrobracon prepupae and pupae were exposed to x-radiation, and the lethal effects of the radiation were studied. Eclosion ratios show that x-rays have a greater lethal effect upon haploid males than upon diploid males or diploid females. Diploid males and diploid females are equally susceptible to the lethal effects of x-radiation. Prepupae are more sensitive than pupae. No significant difference in eclosion ratios was obtained for adults given the same total dose but at different intensities. The response, therefore, seems to be independent of intensity. Comparison of adults developing from irradiated prepupae and pupae shows that a greater number of haploid males show structural malformations than do diploids irrespective of sex and that the haploids show these malformations to a greater degree. Comparison of individuals unable to emerge from cocoons shows that the diploids are in general more advanced in their development than are the haploids. The data show that diploids are more resistant than haploids to the lethal action of x-rays, suggesting that the number of chromosome sets is a factor in determining the radiosensitivity of cells. (auth)

4433 The Differential Response of Male and Female Germ Cells of Sciara Coprophila (Diptera) to Irradiation. Helen V. Crouse. Am. Naturalist 84, 195-202(1950) May-June.

Comparative studies have been made on the response of male and female germ cells of S. coprophila to irradiation. The following results were obtained: (1) When adult females are exposed to x-rays 43 to 45.5 hr after eclosion, no gross rearrangements of any type are recovered; but oocytes irradiated between 46 and 72 hr of adult life yield inversions. (2) Approximately the same number of breaks leading to gross rearrangements are induced by 2,000 r in oocytes and 4,000 r in sperm. (3) Irradiation of sperm results in both reciprocal translocations and inversions. (4) Tests for reciprocal translocations involving the x chromosome yielded 9 such translocations among 108 sperm tested but none among the 42 oocytes examined. The failure to recover interchromosomal exchanges following irradiation of oocytes is discussed. (auth)

4434 Homozygous Translocation Obtained in the Second Generation from Material Treated with Neutrons. Dontcho Kostoff. Proc. Indian Acad. Sci. 30B, 259-63(1949) Nov.

Dry seed from Crepis capillaris were irradiated with neutrons (20,000 r). The effect on the chromosomes are reported, and compared with chromosomal damage due to x-rays. Abnormalities can be classified as follows: 1. Chro-

mosomal dislocations. 2. Chromosomal heteroploidy. 3. Polyploidy.

4435 Influence of Roentgen Rays on the Reactivity of the Skin to the Usual Tests. A. Agostini and C. Stuart. Studi facoltà med. senese 16, 48-52(1948)(in Italian).

A preliminary series of clinico-experimental studies were carried out to evaluate the influence of roentgen rays on the reactivity of the human skin as revealed by the usual tests. In 30 subjects the right half of the back was irradiated in two areas measuring 6 by 8 cm, with 250 r/area delivered at 100 kv, with no filtration; the focus-skin distance was 25 cm, the rate 50 r/min. Twenty-four hours after irradiation, epidermal tests were performed by the direct application of a small square of tissue, 1 cm thick, imbued with the irritant (formol at 10 to 15%; old nondiluted tuberculin). The intradermal tests were made by injection into the skin of 0.1 ml of adrenaline hydrochloride, pilocarpine, diagnostic anatuberculin, or staphylococcal vaccine. The tests were performed in the region of the right half of the back on the skin of the irradiated areas and in the left hemidorsal region as control. Conclusions were that: x-rays have a definite influence on the reactivity of the skin in 50% of the cases, this influence being of an intensifying or of an inhibiting nature; and x-rays act through an indirect mechanism in which hyperemia may play a considerable part.

4436 The Present State of Radiobiology. H. Langendorff. Med. Welt 1, 173-9(1950) Feb. (in German).

This review article summarizes experimental material and theoretical explanations concerning the effect of radiation upon living matter. The view is taken that this effect is caused by individual quantum-physical elementary events. Large numbers of such events must be considered statistically to explain such phenomena as dosage-effect curves. The appropriate statistical target-theoretical concepts are introduced and explained.

4437 The Quantitative Effect and the Qualitative Injury to the Functioning of Thrombocytes Relative to the Retraction of Blood Clots. A. Fonio. Bull. Schweiz. Akad. Med. Wiss. 6, 115-20(1950) May (in German).

Parts of this article discuss the influence of radiation on the retraction of blood clots. Platelet emulsions irradiated by ultraviolet and x-rays show a decrease in retraction with increasing radiation, while very short waves result in a quicker occurrence and an intensified retraction if the radiation has not been too long. Radium irradiation causes an acceleration at the beginning and end of retraction. (auth)

4438 Radioactive Materials as Plant Stimulants — Field Results. Lyle T. Alexander. Agronomy J. 42, 252-5(1950) May.

This article is a report of the results of a field experiment to determine the effect of radioactive elements on plant growth. Several different crops were grown under various climatic conditions. Actinium, radium, and uranium salts were mixed in with the soil. The results indicate that the radioactive materials used have neither a beneficial nor harmful effect on plant growth.

4439 The Radiosensitvity of the Peripheral Nervous System. B. Lindenbaum. Fortschr. Gebiete Röntgenstrahlen 71, 988-93(1949).

After several treatments with deep x-rays, sensitivity changes occurred; applications of the rays to the tongue disturbed taste. These changes were mostly reversible, but only after long periods of time (months).

4440 Some Aspects of the Mechanism of Action of Ionizing Radiation on Living Cells. L. G. Grimmett. Texas Repts. Biol. Med. 8, 134-46(1950).

This article discusses some of the theories advanced to account for the effect of radiation on cells and the sensitivity of cells to varying intensities of radiation. The author emphasizes the role radiochemistry can play in explaining the mechanism of cell damage such as the production of free radicals from water by radiation. 11 references.

4441 Structure and Function of Mouse Ovaries after X-raying. G. J. van Eck-Vermande and J. Freud. Arch. intern. pharmacodynamie 78, 49-62(1949) Jan. 1.

A total of 230 mice (in groups of 3 to 5 animals) under light ether anesthesia were x-rayed from the back without filter, at a focal distance of 78 mm, in 100 or 200 sec, with total doses of 333 or 666 r; ovaries were serially cut; tubes, uteri, and vaginas were extensively investigated at intervals ranging from one day to 3, 7, and 14 weeks after irradiation. The histological findings are reported in detail; one hour after irradiation, marked destructive changes were found in the ovaries, followed by hyperemia and violent follicular atresia with destruction of granulosa cells and fragmentation of the ovocyte during the first days; other results are discussed.

4442 Studies on Lymphocytes from Persons Treated with Radioactive Iodine. William E. Watts and Don R. Mathieson. J. Lab. Clin. Med. 35, 885-9(1950) June.

A study was made to determine whether or not the number and frequency of refractile cytoplasmic granules known to be present in 34% of normal lymphocytes increase on exposure of the host to ionizing radiation. A significant change in the number of frequency of the refractile granules in lymphocytes from persons exposed to ionizing radiation was not found. A search was made for other concise or specific qualitative cytologic effects of irradiation, but none was found. The refractile granules were best studied in fresh, unstained preparations by phase microscopy. (auth)

4443 Studies on the Proteins and Lipides of Plasma Fractions of X-ray-Irradiated Rats. Erland C. Gjessing and Alfred Chanutin. Arch. Biochem. 27, 191-7 (1950) June.

The nitrogen and lipid contents of 4 plasma fractions are presented for rats exposed to nonlethal and lethal doses of x-rays. Pronounced increases in the nitrogen contents of the α_1-globulin-rich Fraction IV-4 and decreases in the albumin-rich Fraction V are seen. The most pronounced changes in the total lipid and cholesterol content are noted in Fraction IV-4. The percentage distribution of the components of the electrophoretic patterns of the 4 fractions do

not deviate significantly from the controls except in the case of Fraction II + III. The γ-globulin content of this fraction is consistently diminished. (auth)

4444 Allergenic Effects of Radiotherapy. P. Le Goff. J. Radiol. Electrol. 30, 624-6(1949)(in French).

Allergic symptoms following x-irradiation are described in five cases. Patients received irradiation delivered at 150 to 250 kv, at 60 to 100 cm target distance, through 0.1 to 1.0 mm Cu in various locations and in doses up to 250 r/area/dose; total doses were up to 10,000 r. The reactions varied for each individual but were characterized by rash and edema; they seemed to be independent of the dose and other radiation factors and the author concludes that allergic reactions depend on a secondary sensitivity factor which is not explained as yet.

4445 The Appearance of the Chief Syndromes Known in Experimental Radio-Physiology in Persons Subjected to Atomic Bomb Explosion. A. Lacassagne. Bull. Acad. Nat. Med. 132, 104-7(1948).

The author points out that atom bomb injury is of the same type as radiation injury which has been known since the beginning of the use of radio-therapy. The time and space zones of effect of the blast are discussed: the first is a zone in which death is caused by suffocation, burns or debris; the second is a zone of 1 to 1.25 kilometers in which total body radiation is as much as 800 r and a high incidence of frequently fatal radiolesions is noted. Within the first few days, death is caused by instantaneous radiation or supervening infection such as gastrointestinal lesions, penumonia, septicemia, and gangrene; after 3 to 4 weeks the death rate increases due to purpura with some cases of complete epilation; up to the end of the first month acute anemia and azoospermy is noted; up to three months a large number of deaths due to malnutrition and cachexia are noted.

4446 Contraindications of Radiotherapy on the Genital Regions of Young Women, Primarily Considering Safety. Alain Nicolle. J. Radiol. Electrol. 30, 662(1949)(in French).

This is a very brief discussion of some factors which influence the decision to use radiation therapy on diseases where the therapy directly or indirectly involves the genital systems.

4447 On the Radioactivity of Thorotrast: A Contribution to the Question of Its Possible Harmful After-Effects when Used for Radiological Visualization. Fritz Ruf and Kurt Philipp. Langenbecks Arch. klin. Chir. u. Deut. Z. Chir. 263, 573-87(1950)(in German).

It is pointed out that thorotrast, containing 22% thorium, is an α emitter. Although the intensity of the emitted α particles is small, detailed measurements and calculations show that over prolonged periods of time the total dosages are large and unsafe. It is therefore recommended to use extreme caution when using thorotrast for arteriography of the extremities, or neurosurgery.

4448 Protective Measures for Working with Radioactive Isotopes. A. Vannotti. Bull. Schweiz. Akad. Med. Wiss. 5, 511-14(1949) Dec. (in French).

The author emphasizes the dangers involved in working with radioactive substances and the precautionary measures workers should adopt.

4449 Radioactive Effects of Atomic Explosions. G. B. Gazzaniga. Scienza e lavoro 5, 18-19(1950)(in Italian).

A short note on mechanical, thermal, and radioactive effects of atomic bomb explosions.

4450 Some Measurements of Gamma-Ray Doses Received by a Radiotherapist During Radium Operations. J. L. Howarth, H. Miller, and J. Walter. Brit. J. Radiol. 23, 245-55(1950) Apr.

Measurements were made over a period of 18 months of the doses of radiation actually received by a radium therapist during operations, (a) by the fingers and hands, and (b) by the body as a whole (integral dose); the doses to the gonads were also estimated. These results are given in a series of tables. The significance of the findings is discussed, with special reference to the permissible tolerance doses, both local and general. (auth)

4451 Some Medical Aspects of Atomic Warfare. A. Lundie. J. Roy. Army Med. Corps 94, 246-58 (1950) May.

Mechanical, thermal, and radiation injuries caused by an atomic bomb explosion are discussed. After exposure to acute total body irradiation, lymphocytes, erythroblasts, germinal epithelium of the testis, myeloblasts, the epithelium lining the base of the gastrointestinal crypts, the germinal cells of the ovary, the basal layer of the skin, and the connective tissue are likely to be injured; bone, liver, pancreas, kidney, nerve, brain, and muscle are less susceptible to the ionizing effects. The acute and moderate radiation syndromes are described in detail, and the histological appearance of the different organs and cells are outlined. The collection and treatment of the atomic casualties, decontamination, hygiene, and other closely related topics are discussed in their relation to the atomic bomb. 54 references.

4452 Stricture of the Mesopharynx as Late Reaction Following X-irradiation of Carcinoma of the Larynx. H. Steinmann. Oncologia 2, 217-32(1949)(in German).

A description of a late reaction following the x-ray therapy of carcinoma of the larynx is presented and observations on 10 patients showing such late reactions are included. The late reaction consisted of a stricture of the mesopharynx; it was present only after large doses of radiation had been delivered, and simulated a recurrence of the malignancy. An attempt is made to explain the development and the constant localization of this stricture in the light of the anatomical and radiobiological circumstances. The author concludes that treatment of the reaction is generally not required. The interval between the completion of radiotherapy and the commencement of difficulties in swallowing on the one hand, and the interval between these and the appearance of anatomical changes on the other, are compared.

BIOLOGY AND MEDICINE

4453 Studies on the Hazard Involved in the Use of C^{14}. II. The Effect of a Single Dose of C^{14}-labeled Sodium Bicarbonate on the Pattern of Deaths from Spontaneous Leukemia in Akm Mice. Howard E. Skipper, Martelia J. Bell, and Jaunita B. Chapman. Cancer Research 10, 362-3(1950) June. (See also NSA 3-1330.)

Leukemia-susceptible Akm mice were injected with C^{14}-labeled sodium bicarbonate at the rate of 18 μc per mouse. This dose has had no significant effect on the pattern of deaths from leukemia in this strain of animals.

4454 Tubercle-like Structures in Late Irradiation Injuries of the Skin. Lars-Gunnar Larsson. Acta Radiol. 31, 17-27(1949).

Pronounced tubercle-like changes in late irradiation injuries of the skin are described in 26 cases; with one exception, they followed radium implantation. These changes are regarded as a peculiar type of tissue reaction due to advanced regressive changes in the connective tissue. Microscopically the changes closely resemble the granulation tissue in tuberculosis, and clinically there are often small nodules which may be mistaken for recurrences of carcinomas.

4455 The Use of Gloves Covered with ThO_2 for Radiological Protection. André Loverdo. Compt. rend. soc. biol. 142, 843-4(1948) June (in French).

The handling of radioactive substances is discussed in terms of the time safety factors for α, β, and γ rays. A rubber glove, covered with ThO_2 was tested as a protective device by determining the extent and depths of different types of radiation penetrating it. The author concludes that exposing the hand to β and α rays from ThO_2 gives limited radiation doses to superficial tissues and that where the dose becomes large the gloves afford some degree of protection by increasing the depths through which the radiation must pass.

4456 Hematologic Changes in Rats Protected by Cysteine against Total Body X-irradiation. Robert L. Rosenthal, Leontine Goldschmidt, and Bryant I. Pickering. Naval Radiological Defense Laboratory Final Report No. AD-215(B), May 3, 1950. 13p.

Following 800 r total body x-irradiation, cysteine-protected rats showed significantly higher neutrophil values in the blood, and more myeloid cells of all stages in the bone marrow, than did saline-injected rats. The possible significance of these findings in relation to mortality and infection is discussed. (auth)

4457 Irradiation Prophylaxis. J. Am. Med. Assoc. 143, 817(1950) July 1 (Editorial).

The use of chemicals to influence the survival rate of irradiated rats is discussed. Cysteine and sodium cyanide administered by injection yield high survival rates with rats subjected to large doses of radiation. Postirradiation therapy proved ineffective.

4458 Lack of Antagonism of Malononitrile and Desoxyribonucleic Acid to Trypanosomiasis, Alloxan Diabetes, and Lethal Effects of X-irradiation. James Preston Parker, Paul I. Ewing, and G. A. Emerson. Texas Repts. Biol. Med. 8, 257-61(1950).

The authors demonstrate that neither malononitrile nor desoxyribonucleic acid, is massive repeated doses, has appreciable effects on experimental trypanosomiasis, alloxan diabetes, or lethal effects of x-irradiation in mice. (auth)

4459 Protective Effect of Para-Aminopropiophenone against Lethal Doses of X-radiation. John B. Storer and Julius M. Coon. Proc. Soc. Exptl. Biol. Med. 74, 202-4(1950) May.

Para-aminopropiophenone (PAPP) when injected intraperitoneally in mice produces a maximum methemoglobinemia in 30 min with only a slight decrease in the methemoglobin level after 60 min. Of 180 mice given a single exposure of 800 r total-body x-radiation, 100% of 60 controls died within 30 days. Pre-treatment of groups of the remaining 120 mice with PAPP in doses of 20, 30, 40, and 50 mg/kg, 30 min before x-ray exposure resulted in 30-day survival rates of 45, 50, 60, and 72.5%, respectively. Injection of 50 mg/kg of PAPP after irradiation did not affect mortality. In a preliminary test pretreatment with PAPP also reduced the 30-day mortality in rats exposed to x-radiation. (auth)

4460 Remarks on the Use of Toluidine Blue in Vivo in the Presence of Excess Anticoagulants. D. Quivy. Compt. rend. soc. biol. 143, 22-5(1949) Jan. (in French).

The effect of toluidine blue on clotting of venous blood diluted with nine different thrombokinase concentrations was tested on five dogs by plots of log of the clotting time against log of the thrombokinase concentrations of 0 to 5000 gamma at intervals of 0, 3, 10, and 53 min after heparin or sulfuric-xylane injections. Therapeutic considerations are discussed and the author concludes that from these experiments it was impossible to confirm any specific toluidine blue action.

4461 Autoradiography. R. H. Herz. Med. Radiography and Photography 26, No. 2, 46-51,84(1950).

The nature and use of radioautography is described in this general article. Such topics are discussed as the photographic material needed, the technique employed in the development of the film, the speed achieved, applications of the radioautographic methods to biology, resolution, quantitative evaluation, interpretation of results, and potentialities of the method. In conclusion, the author notes that it will require some time to perfect a technique which, by detecting the emission of single particles, will permit the study of a localized concentration of tracers or even of a few isolated atoms within biological specimens. This type of approach will have the following advantages: a greatly improved resolution will be possible and will permit the precise location of the origin of a particle; there will be considerable reduction in exposure time; there will be a possibility of working with still more minute quantities of radioactive material; and the production of a type of record that will be less liable to simulation by artifacts will be achieved.

4462 Blood Dyscrasia in Otolaryngology. H. James Hara. Laryngoscope 60, 456-79(1950) May.

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In a survey of blood dyscrasia at White Memorial Hospital in Los Angeles between 1939 and 1949, 159 cases were found in the otolaryngological consultation section. The diagnosis and management of these are discussed including hemophilia, polycythemia vera (treated by P^{32} injections), infectious lymphadenosis, agranulocytosis, thrombocytopenic purpura (treated by x-irradiation), pseudohemophilia, leukemia (treated by x-irradiation and P^{32}), and hereditary hemorrhagic telangiectasia. 137 references.

4463 Cancers of the Anterior Glottis (Radiographic and Radiotherapeutic Considerations). F. Baclesse and R. Henry. J. Radiol. Electrol. 31, 1-7(1950)(in French).

The diagnostic details of this type of cancer, which is usually in the region of the anterior commissure are given, including radiographs from some of 66 cases found among 863 endolaryngeal cancers. Radiotherapy in 9 limited cases resulted in 8 apparent cures, while 4 cases of extensive involvement resulted in 1 cure; radiation was delivered by a 180 to 200 kv machine, filtered by 1 mm Cu and 2 mm Al, at a focal distance of 50 to 60 cm, at a rate of 15 to 20 r/min, through two transverse and one anterior port, for total doses of 6000 to 8000 r administered over 6- to 8-week periods.

4464 Cancer of the Penis and the Present State of Its Treatment. P. Desaive and H. Ramioul. Acta Chir. Belg. 49, 253-315(1950) Mar. (in French).

A complete review of the subject from every consideration (etiology, diagnosis, and methods of treatment) is given, including extensive tables of data on cases taken from the literature. Among the 79 cases observed in particular, 23 were treated with radium doses of about 4000 mg-hr alone resulting in 13 cures, and 6 were treated with contact radiotherapy in total doses of 6000 to 16,000 r, delivered by 200-kv machines, with filtration of 1 to 2 mm Cu and 1 to 2 mm Al, at a focal distance of 40 to 45 cm, in fractionated daily doses, giving one cure and three possible cures (still under observation). The author concludes that 58% of the cases of penile cancer treated with some type of radiation showed favorable results over periods of more than five years. 230 references.

4465 Cancer of the Uterine Cervix. Frithiof Truelsen. London, H. K. Lewis and Co., Ltd., 1949. 440p.

A report is presented concerning the clinical features and radiotherapeutic results in 2918 cases of cancer of the uterine cervix. The following subjects are covered in separate chapters: the development of radiotherapy; the treatment of carcinoma of the cervix uteri in Denmark; a survey of the technique of radiotherapy; the material used (cases, surveys, etc.); the treatment and the results of the treatment; complications of the treatment; an evaluation of factors which may influence the prognosis; recurrences; coexistence of carcinoma and other conditions; and, the terminal stage of cervical carcinoma. Among the complications occurring during or after therapy, sepsis, perforation, occulsion, phlebitis and embolism, hemorrhage, complications of the urinary tract, primary bladder and rectal conditions, and others are mentioned. A summary is included along with the list of cases and 505 references.

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4466 Cancer of the Uterine Collum in Stage I. 1. Local Sterilization by Radiumtherapy. Adverse Results of Radium Therapy and Radium-Surgical Therapy. 2. A Study of External and Internal Iliac Adenopathies. A. Tailhefer and N. Thierry. Mém. acad. chir. 76, 364-72(1950) Mar. 8 and 15 (in French).

A discussion is presented of the topic in order to evaluate therapeutic methods on the basis of cures obtained. A special discussion is given of 39 cases where surgical procedure was combined with radiumtherapy in doses less than 50 mc and in 31 cases where the radiation dose was 60 mc. Surgical procedures involved panhysterectomy and colpohysterectomy. The authors conclude that the combination of methods gives better results than other methods. 26 references.

4467 Carcinoma of the Cervix. A Report of 200 Cases Treated with Radium and X-rays. George C. Wilkins. New Engl. J. Med. 242, 895-6(1950) June 8.

The results of the treatment of 200 cases of carcinoma of the cervix by a combined x-ray and radium method are described. A total x-ray dosage of 7600 to 9000 r was delivered in each case before the application of radium therapy. The radium technique which followed consisted of inserting 75 mg of radium in a brass tube into the cervical canal, and placing of 25 mg of radium just above the cervical canal for about 24 hr; on the second day after this application 100 mg of radium in a T-tube was applied, 50 mg in the cervical canal and 50 mg either anteroposterior or transverse to the canal, as indicated by the location of the lesions; three weeks later, a third application, usually a repetition of the first was also given. The treatments delivered a total dose of 5600 to 5800 mg hr. The statistics from a group of 185 patients treated by the radium method alone are compared with those obtained by the x-ray-radium method; with radium alone, a 37% five-year salvage rate was obtained. The combined method also yielded a 37% five-year salvage rate. The author concludes that there are certain clinical advantages to x-ray therapy, but the main agent in influencing the curability in the radiation therapy of cervical carcinoma cases is radium.

4468 Considerations of the Prognostic Value of Variations of the Sedimentation Rate in the Roentgentherapeutic Treatment of Malignant Lymphogranuloma. Paolo Emilio Panzironi and Mariano Guttadauro. Radiologia (Buenos Aires) 5, 441-6(1949) Oct.-Dec. (in Italian).

In a group of 20 individuals affected by malignant lymphogranuloma the authors have studied the alterations occurring in the erithrosedimentation rate after a certain number of roentgen exposures. On the basis of the comparative observation of the clinical course of the condition and the variations of these values, the authors maintain that the sedimentation rate represents an index of high prognostic value, which sometimes may be rather superior to the one obtained by clinical and laboratory examinations. Furthermore, they point out that it may also represent a probative source of judgement both for the efficiency of the roentgen treatment and for the time in which the patient should be placed under control and further treatment.

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4469 Contact Radiotherapy in the Treatment of Sclero-Corneal Rim Epithelioma. P. Bétoulières, Ch. Boudet, and N. Battesti. J. Radiol. Electrol. 31, 92-5(1950)(in French).

After a discussion of methodology used, three cases are presented in detail. The general technique involves preventative antibiotic administration and x-irradiation delivered at 50 kv, filtered by 1 mm Al, giving a maximum total dose of 10,000 r, administered in 1200 to 1500 r doses daily or three times a week; accidents caused by this method are discussed and the author considers that the only contra-indication for irradiation is extensive local neoplasmic involvement. The results are too recent to permit definite conclusions to be reached but further work on other cases will use this technique.

4470 The Internist and Radioiodine. Seymour L. Cole. Ann. Western Med. Surg. 4, 276-81(1950) June.

The applications of radioiodine to diagnostic and therapeutic procedures are described. The author notes that the value of radioiodine depends upon the internist's understanding of the factors affecting its uptake and utilization by thyroid tissue. From the percentage uptake of a tracer dose of radioiodine, the internist can determine whether an individual is hyperthyroid, euthyroid, or hypothyroid. Radioiodine is considered useful in the diagnosis of myxedema and thyrotoxicosis, and in differentiating the latter from thyrotoxicosis factitia, thyroiditis, and certain anxiety states; it is also of use in distinguishing the hyperfunctioning nodule from Graves' disease with an incidental nonfunctioning nodule, and in recognizing aberrant thyroid tissue, as well as malignant metastases. Within two weeks after the I^{131} therapeutic treatment may appear the infrequent symptoms of increased hyperthyroidism and thyroiditis, but there is such a paucity of harmful side effects that the treatment is considered fairly safe; indeed, a dose of 10 to 100 times that used in thyrotoxicosis is delivered to thyroid carcinoma cases without much increased danger. Radioiodine's efficacy, ease of administration, and lack of side effects as compared to other modes of therapy make it the agent of choice in the management of thyrotoxicosis.

4471 Investigations into Differentiation and Other Morphological Changes in Malignant Tumours Following Therapeutic Irradiation with X-rays and Radium. S. Ry Andersen. Copenhagen, Einar Munksgaard, 1949. 112pp.

A careful survey of the earlier investigations bringing the information down to date is followed by details of the author's numerous investigations; squamous-cell carcinoma, mammary carcinoma, spindle-cell sarcoma, and chondrosarcoma transplantable in mice were studied. In the human being skin carcinoma, mammary carcinoma, and carcinoma of the cervix, were investigated. The author concludes that therapeutic irradiation of a number of suitable malignant tumors with x-rays or radium is not followed by histologically demonstrable changes interpretable, with our present knowledge of morphology, as criteria of differentiation; the dosage used in clinical radiotherapy should not be adapted to alterations, if any, in the differentiation during or after the irradiation, because he does not consider these a fit standard for foretelling the tumor response to the radiation.

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4472 Morphologic Changes in the Thyroid Gland Following Radioiodine Therapy. Marvin R. Shapiro. Ann. Western Med. Surg. 4, 274-5(1950) June.

Biopsy specimens were taken from patients with large toxic goiters before I^{131} was given and at intervals during and after therapy in order to determine the nature and extent of the morphological changes in the thyroid brought about by the isotope. It was found that the thyroid gland could be destroyed or its glandular activity suppressed by the administration of variable doses of I^{131} to human subjects suffering from thyrotoxicosis. It is concluded that this therapy is in effect a medical type of thyroidectomy.

4473 A New Supporting Apparatus for the Application of Radium to the Penis. X. Vilanova and Corominas F. Oller. Actas Dermo-Sifiliográficas 40, 449-52 (1949)(in Spanish).

In order to avoid the disadvantages of radium insertion and the difficulties of modeling an easily adjustable surface apparatus, the authors devised aluminium plates, each of which serves as a support for a radium tube, the focus-skin distance of which may be varied by a very simple device. These plates may be interlinked and attached to the skin, being adjustable to the various parts of the penis and remaining fixed in spite of the continuous changes in form and volume of this organ in the course of an irradiation with radium of medium or long duration.

4474 On Pre-operative X-irradiation (Pre-irradiation). Otto Wichtl. Wien. klin. Wochschr. 61, 24-6(1949) Jan. 14 (in German).

The disadvantages and advantages of preoperative radiation treatment of tumors with x-rays or radium are surveyed. Such treatment may be used for the reduction of malign tumors or for the more general purpose of devitalization of the tumor cells. The author is of the opinion that small radiation doses (below 1000 r) have the best effect and that the objection made by several investigators, namely, that pre-irradiation would favor the occurrence of metastases, is not justified. 20 literature references.

4475 On the Roentgen Therapeutic Treatment of Some Diseases Associated with the Pain Syndrome. Piero Bistolfi. Radioterapia, radiobiologia e fisica medica 2, 145-63(1949)(in Italian).

The results of the treatment with radiotherapy of 78 cases of the pain syndrome (encountered in essential neuralgia, Herpes zoster, neuralgia secondary to a lesion and malformation of the spinal cord, and in other conditions) are presented. The patients were usually treated with total doses of 150 to 900 r/field delivered to one or more fields in a course of therapy; several courses were often given to effect a cure. The author concludes from the satisfactory results obtained that radiotherapy is an effective method and an efficient means of alleviating pain.

4476 On the Short-Distance Therapy of Lupus Carcinoma. A. Kautzky. Strahlentherapie 81, 353-8(1950)(in German).

After many disappointing attempts to use short-distance x-ray technique for the treatment of the lupus carcinoma, the author found that satisfactory results are obtained if,

with no regard to the danger of necrosis, the dosage is determined solely by considering the conditions that lead to the destruction of the malignant tissue. He recommends about 10,000 r in, at most, 20 irradiations, it being essential that the dose exceed 8000 r and be administered in less than 35 days.

4477 On the Use of Plesiotherapy in Fistular Abscesses Localized in the Vagino-rectal Septum. Pietro Amisano. Radioterapia, radiobiologia e fisica medica 2, 179-83(1949)(in Italian).

A case of a vagino-rectal abscess, fistulate toward the rectum, had resisted all previous interventions, the various therapeutic methods applied having produced only slight and transitory improvements. The author used endoplesiotherapy with a Siemens setup (Chaoul tube, 55 kv, 5 ma, focal distance 1.5 cm) and obtained a complete regression of the abscess. The total dose was 2000 r, distributed in four treatments of 500 r each, three vaginal and one rectal, applied during a 66-day period. (auth)

4478 Our Experience in the Treatment of Cancers by Artificial Radioelements. A. Herve. Rev. med. Liege 5, 322-31(1950) June 15 (in French).

This article is a report of the work done at the Anticancer Center of the University of Liege where P^{32} in the form of H_3PO_4 was injected intravenously into patients with leukemia, lymphosarcoma, and Hodgkin's disease and I^{131} in a $NaHSO_3$ solution was administered to patients with cancer of the thyroid and cryptogenetic metastasis which was suspected of having a thyroid origin. Curve and tables showing the elimination of the radioelement from the body for the various diseases discussed are included. The author expresses a great deal of pessimism regarding the value of radioelements in cancer therapy.

4479 Polycythemia Vera. O. Raymond Russell. Quart. Bull. Indiana Univ. Med. Center 12, 16-17(1950) Jan.

The symptoms, pathology, and therapy of polycythemia vera are discussed; x-ray spray and P^{32} are considered in application to this disease. Technical factors in the use of x-ray spray are 200 kv, at a focal distance of 180-230 cm, filtered by 0.5 mm Cu and 1 mm Al, alternating half body anterior and posterior ports, giving a total of 200 to 250 r to each port. Complications of both types of therapy are also mentioned.

4480 The Present Status of Radio-Therapy and the Radio-Isotopes in the Treatment of Cancer. 2. Radioisotopes. M. Weinbren. S. African Med. J. 23, 600-8(1949) July 16.

A discussion is presented on the use of radioisotopes in therapy. Among the radioisotopes discussed are I^{131}, P^{32}, Na^{24}, and Co^{60}; P^{32} is claimed to be a substitute for x-rays in the treatment of polycythemia vera; I^{131} is mentioned in the treatment of hyperthyroidism. The author observes that some leukemic and cancerous conditions cannot be treated by the radioisotopes; Hodgkin's disease, the lymphomas, multiple myelomata, bone tumors and secondary deposits in bone do not respond to the radioisotopic radiations. The author concludes that radioisotopes have not been proved to be of much value; not a case of cancer, excluding rodent ulcers, has been cured by the isotopes. The amount of research work done so far is still small and so treatment with radioisotopes in the future may assume a more vital role. 95 references.

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4481 Pre(operative) X-irradiation of Mammary Carcinoma. Martin Steingräber. Bruns' Beitr. klin. Chir. 179, 305-17(1950)(in German).

The purpose of this investigation was to determine the therapeutic effect of preoperative x-irradiation in cases of mammary carcinoma. The results obtained with 26 patients are analyzed, half of which were given dosages between 1000 and 1500 r, the other half dosages of 2400 r (irradiation conditions: 180 kv, 5 ma, 0.5 cm Cu, 40 cm target distance, 26.1 r/min). It was found that lymph node metastases are rather insensitive to radiation, and that after irradiation in all cases histological traces of the primary tumor could be detected. The author concludes that x-irradiation cannot serve as substitute for an operation.

4482 Progress in the Treatment of Blood Dyscrasias. Willis M. Fowler. J. Iowa State Med. Soc. 40, 51-7(1950) Feb.

An analysis is given of the use of various therapeutic agents in blood dyscrasias in order to evaluate them and consider their limitations. Folic acid, vitamin B 12, nitrogen in mustard, urethane, stilbamidine, aminopterin, and radiophosphorus are discussed; P^{32} is useful in chronic myelogenic leukemia and polycythemia vera but the author concludes that the main danger of its use in the latter is in its conversion of polycythemia to leukemia and a development of marrow aplasia. He further concludes that P^{32} therapy has little advantage over venesection and the postoperative irradiation that is usually used.

4483 Radioactivity of Waters and Its Therapeutic Applications. Francisco de A. Trelles. Arch. inst. nacl. hidrol. climatol. med. 3, 114-22(1949)(in Spanish).

The author reviews the principal works on the therapeutic uses of naturally radioactive water.

4484 Radio-Iodine. A. J. Wood. Bull. Vancouver Med. Assoc. 26, 201-2(1950) May.

A general discussion is presented on the characteristics of radioiodine and its various applications to the medical field. Radioiodine is mentioned in connection with studies of iodine metabolism and thyroid function and in the treatment of noncancerous pathological states. The treatment results, from a number of sources which are tabulated, demonstrate the efficiency of I^{130} and I^{131}. The author concludes that routine use of radioiodine for therapeutic purposes must await a further elucidation of iodine metabolism, a careful scrutiny of the treated cases over an extended period of time, and the training of certain essential and highly skilled personnel needed for the assessment of radiotracers in biological materials.

4485 Radioiodine in the Diagnosis and Treatment of Thyroid Disease. Henry L. Jaffe. Ann. Western Med. Surg. 4, 272-3(1950) June.

In a previous communication it was noted that the radioiodine-uptake test as a diagnostic test for thyroid disease

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was more accurate than the basal metabolic rate or the protein-bound blood iodine test. This article briefly describes the technique involved in the radioiodine-uptake test. The procedure is also given for the radioiodine treatment of thyrotoxicosis. Each patient is given a tracer dose of 100 μc of I^{131} orally; if the results of a 24-hr uptake test are within the toxic range, the first oral therapeutic dose, usually 5 to 8 mc, is then given. Further doses are given until the patient demonstrates a normal iodine uptake. Of 148 patients treated with radioiodine and followed for six months or more, 72.3% responded to the first dose of I^{131} and 16.9% to two doses. The remainder of the group were considerably improved but not euthyroid; 62% of the entire group were thyrotoxic patients, and 13% were patients with toxic nodular goiter. I^{131} also served as an excellent form of therapy for patients who had been previously subjected to surgery and who suffered recurrences. All these patients returned to a euthyroid state after the I^{131} treatment.

4486 Radioiodine in the Treatment of Thyroid Disease. Howard B. Hunt, Ralph C. Moore, Capres S. Hatchett, and E. Stanley Pederson. Nebraska State Med. J. 34, 416-20(1949) Dec.

Forty-five patients with thyrotoxicosis (31 of whom had diffuse toxic goiters and 14 of whom had toxic nodular goiters) were Treated with I^{131}; 4 patients with cancer of the thyroid were also treated. A total of 90% of the diffuse toxic goiter cases have showed remission of toxic symptoms within two months following treatment; the toxic nodular goiter cases also showed improvement, although relatively larger doses had to be given because of less retention of the radioiodine. Before any therapeutic doses were administered to the thyrotoxic patients, a preliminary retention test dose of 100 μc of I^{131} was given orally to the fasting patient; the urine was collected for the following 24- and 48-hr periods, and radioactivity measurements were made on the sample and on the thyroid. The average retention of the I^{131} after 24 hr was 70% for all the 45 cases of thyrotoxicosis. One follicular cell carcinoma of the thyroid remained well for 15 months following a total thyroidectomy, deep x-ray therapy, and the administration of I^{131} in massive dosage.

4487 Radiotherapy. J. Walter and H. Miller. Philadelphia, Blakiston Co., 1950. 444p.

This book on radiotherapy is termed a short textbook for technicians and students and contains a supplemental chapter for the dermatologist. Such topics as the structure of matter, the physical properties of x-rays, the generation of x-rays for therapy, the physical aspects of x-ray therapy, the physical properties of radioactive materials, biological and pathological introduction, the biological effects of radiation, methods of radiation (radium and x-rays), principles of treatment and dosage, illustration of the technique in malignant and nonmalignant cases, the protection of staff in radiotherapy departments, duties and responsibilities in the radiotherapy department, and (as a supplement) radiotherapy in dermatology are covered in separate chapters. An appendix includes the recommendation of the British X-ray and Radium Protection Committee and a discussion of artificial radioactivity and its medical applications. A book list, addendum, and an index are also provided.

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4488 Radiotherapy of the Cervical Sympathetic System in Functional Troubles of Vasomotor Origin in the Course of Hypertensive States. Gaston Daniel. J. Radiol. Electrol. 31, 90.1(1950)(in French).

A discussion is given which includes classical functional syndromes, complications such as cervical-brachial neuralgia, acroparaesthenia, scapulo-humeral arthritis and peri-arthritis, dyspnea, retinal hemorrhage, and endocrine involvements. In asthmatic dyspnea, x-irradiation is delivered at 140 kv giving a dose of 120 r; in retinal hemorrhage x-irradiation of two lateral neck ports in eight doses of 200 r is used. The author concludes that radiation may prove as efficacious in the therapy of this condition as other palliative methods already in use.

4489 Radiotherapy for Excessive Sweating of the Palms and Soles. J. Belot. J. Radiol. Electrol. 31, 114-16 (1950)(in French).

After a discussion of the phenomena including its possible sympathetic causes, a complete description of the technique of radiotherapy used is given. The hands are x-irradiated by a 110-kv machine, filtered by 2 mm Al, at a skin distance of 25 cm, giving an initial dose of 300 to 350 r followed by doses of 250 to 300 r for six daily doses; each series is separated by 12 to 15 days; relief is noted after the fourth treatment and rarely more than two series are necessary for complete remission. During the treatment period the hands are protected from chemical irritants, and sympathetic irradiation is given where indicated by a 200-kv machine, filtered by 1 mm Cu and 2 mm Al, in 150 r doses, three or four times at 8 to 10 day intervals. Similar treatment is given to the feet with doses of 200 to 300 r in a series of six doses, with each series separated by a period of 8 to 10 days. The author concludes that despite the difficulties of the technique, good results may be realized with careful attention to detail.

4490 Radiotherapy of Pituitary Adenomas. Franz Buschke. Western J. Surg. Obstet. Gynecol. 58, 271-8(1950) June.

An analysis is presented of the results of the treatment of chromophobe and eosinophil pituitary adenomas by radiation therapy. At the Tumor Institute of the Swedish Hospital, Seattle, Washington, x-rays were delivered at 800 kv with a 9.1-mm Cu hvl in daily doses of 300 r to the skin through two 6 by 6-cm ports. Total doses of 7000 to 8000 r were delivered over the course of four to seven weeks. The total effective tumor dose with this technique was about 3800 to 4500 r. The techniques of other authors are compared with this technique. Of nine patients with chromophobe adenomas treated at the Tumor Institute, six have remained well for periods of one to nine years. The author concludes that, on the basis of experiences and material reviewed, radiation therapy in the form of a single massive dose is the primary procedure of choice in cases in which a diagnosis of pituitary adenoma can be made with a reasonable degree of certainty, and in which the damage to the optic nerves has not yet reached the point of imminent danger of blindness. In patients with imminent danger of blindness, primary surgical decompression of the sella is preferable. Other conclusions are presented.

4491 Radium Therapy for Impaired Hearing. Norton Canfield and David Sudarsky. Modern Med. 18, 58-9(1950) May 1.

This article is similar to one which appeared in Ann. Otol., Rhinol. & Laryngol. 58, 957(1949) Dec. An abstract of the article appeared in Nuclear Science Abstracts as abstract 4-2187.

4492 Roentgen Ray Treatment of Tinea Capitis. Charles F. Roland. Grace Hosp. Bull. 27, 29-33(1949) Jan.

A survey of 125 cases of tinea capitis in children out of 130 cases treated by x-ray epilation was made; they had received x-irradiation delivered by a 100-kv machine, 0.5 mm Al inherent filter, radiating five ports at a distance of 8 to 8.5 in., in doses of 360 to 380 r in air, administered to each port. The epilation time, regrowth time, texture, color, and area of regrowth of hair and the results are discussed. The author concludes that the cure rate of 98% indicates that this is the preferred treatment of the condition.

4493 Roentgentherapy of Purulent Collections. (Is Radiotherapy of Drainage a Technical Problem? Posology, Spreading or Ballistics). Gaston Daniel. J. Radiol. Electrol. 31, 89-90(1950)(in French).

Radiotherapy is used in cases of anthrax of the nape of the neck in superficial doses. The author suggests the use of deeper doses for drainage with radiation delivered in a limited area of 2-3 cm^2, at 70 kv, filtered by mm Al or 85 kv, filtered by 2.5 mm Al, in daily successive doses of 13, 13, 25 r for three days followed by 70 r/day for three days and then 250 r, to effect resorption. A discussion of the use of combined techniques involving surgical drainage, sulfa administration, and penicillin therapy is given.

4494 Statistical Data on 54 Cases of Syringomyelia Systematically Treated with X-rays. R. Amici. Minerva med. 2, 218-21(1949) Aug. 25 (in Italian).

In a report from the Neurological Institute, Milan, the author gives the results of treatment with deep x-rays of 54 cases of syringomyelia, including 6 of syringobulbia, 15 of syringobulbomyelia, and 33 of true syringomyelia. The method recommended involves the use of three or four longitudinal median fields to irradiate the whole of the spinal cord, and two lateral fields to irradiate the brain stem, if involved. Radiations of 160 to 180 kv, with a 0.5 mm Cu and 1 mm Al filter, and a target distance of 40 cm were used. The dose given was 800 to 900 r (in air) per field, the course being repeated after two months; this dosage was sufficient to bring about an improvement in a large proportion of the cases. The condition improved in 72%, did not change in 24%, and deteriorated in 4% of the cases; in many cases relief of pain or paraesthesia was noted even after one treatment. Increase in muscular power, return of sensation, and healing of trophic ulcers occurred in a large porportion of cases; involvement of the brain stem appeared to diminish the possibility of successful x-ray therapy.

4495 A Statistical Procedure for Short-Term Testing of New Methods of Treatment of Malignant Tumors. Henni Gärtner and Hans Münzner. Strahlentherapie 81, 267-72(1950)(in German).

A sound judgment on the merits of a new therapy of malignant tumors can be made only after five years of post-treatment observation. This is a long delay, and one would welcome some short-cut procedure based on a comparison of the results shown, so far, by a new method B with the known results obtainable with an old method A. The authors devised such a statistical procedure and, as an illustrative example, used carcinoma portionis uteri, since detailed statistics are available on the results of the radiological treatment of this disease. They prepared a table giving the survival probability at any given moment in the five-year period for any form of the above disease having been treated according to the current radiological methods (method A). If some survival data have been obtained during a period of time with a new therapeutical method B as applied to certain forms of the disease, those data can be compared with the survival probabilities of the method A (given by the above table) for the same disease forms and the same period of observation. An estimate of the comparative value of the two methods can thus be made.

4496 A Study of the Activity of the Phosphatases, and of the Calcium, Potassium, and Inorganic Phosphorus Contents in the Blood of Patients with Neoplasia, Having Undergone Radiological Treatment. Bruno Bertiglia and Rina Celeghini. Radioterapia, radiobiologia e fisica medica 2, 184-202(1949)(in Italian).

This is a contribution to the study of the changes in the phosphatases' activity and in the mineral exchange that are produced by cancer and modified by radiological treatment and hormonotherapy. The examination of 30 patients, before and after treatment, resulted in the following findings. Phosphatasemia, in one-third of all cases, was decreased by the irradiation; it was increased by the use of male hormones. No regularities were observed with regard to the variations in the calcium, potassium, and inorganic phosphorus content of the blood; the last named element was in excess with respect to the normal, but the changes produced by the treatment were equivocal.

4497 A Study of Renal Function with the Aid of Radioactive Phosphorus. L. Ström. Acta Paediat. Supp. 77, 160-3(1949).

Phosphate excretion experiments were conducted on 50 children at the Norrtull Hospital in Sweden with the aid of an intravenous injection of P^{32}; 300 to 500 cc of H_2O was first introduced into the fasting stomach and 30 min later the urinary bladder was emptied; the isotope was then injected and blood specimens were taken 1 min, 0.5, 1, 2, and 3 hr later; urine samples were taken 5, 10, 15, 30, 60, 120, and 180 min after the injection, and the radioactivity of all specimens was measured. It was shown that the specific activity of the urine was much greater than that of the blood. Cases of nephritis demonstrate a greatly diminished excretion of the phosphate; simultaneously with improvement of the clinical symptoms, the excretion of the phosphate increased.

4498 Supervoltage Roentgentherapy. Franz Buschke, Simeon T. Cantril, and Herbert M. Parker. Springfield, Illinois, Charles C. Thomas, 1950. 297p.

This book presents the technique and the results of the high-voltage roentgen therapeutic treatment of carcinomas of the oral cavity, pharynx, esophagus, maxillary sinus, larynx, bladder, breast, cervix uteri, and pituitary adenomas,

in separate chapters. A potential of 800 kv was normally used with a filtration of 4.5 mm Pb + 3 mm Al + 3 mm Celluloid + 0.8 mm Sn + 0.26 mm Cu; total doses varied according to the individual cases. From the results obtained by this method the authors conclude that two advantages may be anticipated: an improved depth dose may be expected to occur; and a lesser volume dose results due to the more forward scattering of the rays. A lesser total quantity of energy is absorbed by the body as a whole, an increased skin tolerance is noted, and general toxic effects are minimized (radiation sickness, etc.); the peripheral range of unwanted irradiation is limited, allowing a greater depth dose delivery. Over-exposure may occur with this method, however, due to the lack of an efficient index of reaction. The authors also conclude that it is theoretically unlikely that a further increase in the voltage of the x-rays will add appreciably to curability of cancer. Further progress in radiation therapy of cancer will come rather from the application of existing knowledge to all patients who require it. A bibliography is presented after each chapter, and an index appears at the end of the book.

4499 Tables for the Dosimetry of X-rays. Leonhard Grebe and Werner Wiebe. Supplement to Strahlentherapie, Vol. 25. Berlin, Urban and Schwarzenberg, 1950. 152p.

Extensive tables are given which provide information of importance for x-ray dosimetry on the following subjects: measurement of high voltages by measuring the range of sparks between spheres, half-value layers of x-rays in aluminum and copper and the homogeneity of the x-radiation, decrease in radiation by scattering and absorption in various substances, and dosage tables. An explanatory text describes the measurement of x-ray energies, the laws of the absorption and scattering of x-rays and the relation between surface and depth intensity. 138 literature references.

4500 Therapy Problems of the Trigeminus Neuralgia. G. Schulte and K. Krautzun. Strahlentherapie 81, 301-4(1950)(in German).

The true cause of the trigeminus neuralgia is a disturbance of the vasomotor regulation. Led by this interpretation, the author irradiated the blood vessels of the medulla oblongata region. The dose was 150 to 180 r (30-cm focus-skin distance) administered in the back of the neck. This was repeated once or twice with 4- to 6-week intervals. Disappearance of the pain, confirmed by two-year observation, was observed in 34 cases. The results was more satisfactory than those obtained by irradiating the peripheral parts or the ganglia of the trigeminus.

4501 Twenty-year Review of 405 Cases of Cancer of the Tongue, Cured by Radiological Methods. Carlo Porta. Tumori 23, 14-22(1949)(in Italian).

A survey was made of 405 cases of malignant neoplasia of the tongue cured by radiological methods at the Tumor Institute of Milan, Italy, in 1928-1945. No selection being made between degrees of gravity of the disease, the proportion of cured patients was found to be 22.4% of cases with an observation period of three years or longer. All data concerning latero-cervical adenopathies, the area of the

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original lesion, necrosis, and relapses were taken into consideration. It seems that future progress should be expected not so much from technical improvements of the methods as from a better organization of the clinical material, such as earlier diagnosis, which will permit a more adequate and efficient application of therapeutic methods. (auth)

4502 The Use of Bucky-Rays in Ocular Diseases. P. Mezey. Szemeszet 86, 77-9(1949)(in Hungarian).

The use of Bucky-rays in the treatment of 54 patients with superficial eye diseases is discussed. Radiation was delivered a distance of 2.5 cm, in 100 to 400 r doses, every other day, giving a total dose of 600 to 1600 r. Good effects were obtained in cases of blepharitis but the author concludes that the results in corneoscleral conditions are not convincing.

4503 X-ray Treatment of Carcinoma of the Cervix. R. Du Mesnil de Rochemont. Strahlentherapie 78, 511-26(1949).

At the Marburg Clinic two anterior and two posterior transverse fields and one perineal field are used, each one 8 by 15 cm. The anterior and posterior fields are not side by side, but one above the other. All fields are centered toward the cervix. A tumor dose is calculated to deliver 3000 r in protracted fractionated treatment. For the central portions of the pelvis, an additional radium dose is given during this course of x-ray therapy calculated to bring the total dose in the region of the bladder and rectum to what is considered the tolerance dose of 7000 r. A comparison of results in different clinics obtained with massive short time treatment up to 1000 r tumor dose, with fractionated prolonged treatment up to 3000 r tumor dose, and with fractionated prolonged treatment above 3000 r tumor dose, shows optimal results in the second group for stages III and IV, whereas for stages I and II the two latter types of procedure give about comparable results.

4504 Acute Toxicity of Zirconium, Columbium, Strontium, Lanthanum, Cesium, Tantalum, and Yttrium. Kenneth W. Cochran, John Doull, Marcella Mazur, and Kenneth P. DuBois. Arch. Ind. Hyg. & Occupational Med. 1, 637-50(1950) June.

Aqueous solutions or suspensions of compounds of Zr, Cb, Sr, La, Cs, Ta, and Y were administered in single doses by intraperitoneal injection or orally by stomach tube to male and female rats. Observation was made for 10 days, since the animals either recovered or succumbed during this period. The LD_{50} values are given for the various compounds used. Differences in these values are pointed out for the several compounds of each element studied, and the dependence of these values on the route of administration (oral or injection) is discussed. 28 references.

4505 Chronic Pulmonary Granulomatosis in Residents of a Community Near a Beryllium Plant: Three Autopsied Cases. Charles Chesner. Ann. Internal Med. 32, 1028-48(1950) June.

This article is a report of 3 autopsied cases of chronic pulmonary granulomatosis occurring in residents near a beryllium plant and some of the findings relative to beryllium toxicity made by other workers in the field. Good correlation

does not exist between the severity of the disease and the degree of exposure. The onset of the disease in the worker cases was delayed for periods of 27 mo to 4½ yr after the last exposure. Sputum studies and other laboratory examinations were essentially negative. The chief autopsy findings were confined to the lungs. The microscopic sections showed a diffuse replacement of the lung parenchyma by a nodular and diffuse granulomatous lesion. The focal areas were always prominent. Granulomatous lesions were always present in the hilar lymph nodes and less frequently in the liver and spleen. The patients died of pulmonary insufficiency with right-sided heart failure. Beryllium was recovered from the tissues in two cases. Spectrographic analysis of the lung ash in one case revealed the presence of beryllium. The author suggests the continued use of autopsies to help in the determination of the relationship between exposure, the finding of beryllium in tissue, and disease. 19 references.

4506 Chronic Retarded Pneumopathies of Beryllium. Rev. tuberculose 13, 832-7(1949)(in French).

The pulmonary embarrassment provoked by the inhalation of beryllium dust or powder is of two types: the immediate and transitory pulmonary effects often associated with cutaneous and ocular manifestations; and, the chronic retarded pneumopathies. The results of personal observations of the latter type of beryllium cases and a review of 36 cases by Hardy are presented. The habitual clinical symptoms are emaciation, fatigue, coughing, and dyspnea; the troubles are due more to the beryllium itself than to the silicates and fluorides present with the beryllium. The evolution of pulmonary nodular development is traced through the reticular, micro-nodular, and nodular stages. Some medical legal aspects of beryllium poisoning are also discussed.

4507 Effect of Uranium Poisoning in Partly Pancreatectomized Dogs. F. Grande, J. C. de Oya, and C. Jiménez Díaz. Bull. Inst. Med. Res. Madrid Univ. 2, 53-5(1949).

In dogs with approximately 70% of the pancreas removed, damage to the kidneys by uranium nitrate (3 mg/kg intramuscularly) did not provoke the onset of diabetes. The blood sugar level remained normal indefinitely.

4508 A Histochemical Study of Alkaline Phosphatase in the Lungs During Experimental Pneumopathy Caused by Beryllium. A. Policard and A. Fulleringer. Compt. rend. soc. biol. 143, 1411-12(1949) Nov. (in French).

The inhibition of alkaline phosphatase by beryllium was tested in rat lungs 11 months after an induced berylliosis. The Gomori technique showed a positive reaction in bronchial and bronchiolar epithelial cells, large histiocytes adhering to the alveolar walls, and some large histiocytes of the periarterial, peribronchiolar, and peribronchial connective tissue and under the pleura. The author concludes that two structures of the lung contain alkaline phosphatase: bronchial and bronchiolar epithelium, and their immediately subjacent connective stroma.

4509 National Academy of Medicine, Meeting of April 25, 1950. Gazette hôpitaux 123, 272(1950) May 13 (in French).

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Among the papers presented was: The Importance of Fluorescent Elements in the Pathogenesis of Pneumopathy Caused by Dusts Composed of Beryllium Compounds, M. Policard. This paper concerns the compounds found in industrial dusts and their pathological effects on the human respiratory system.

4510 Rapid Production of Atherosclerosis by Administration of Uranium in Presence of Hypercholesterolemia. Campbell Moses and Grace M. Longabaugh. Proc. Soc. Exptl. Biol. Med. 74, 92-3(1950) May.

Rabbits were fed doses of cholesterol to produce a condition of hypercholesterolemia after which uranium acetate was administered subcutaneously to cause kidney damage. Two to 14 days after the administration of the uranium acetate the animals were sacrificed and the aorta was examined microscopically. In almost all cases atherosclerosis was very marked.

4511. Vanadium Pentoxide Poisoning. S. G. Sjoberg. Nord. Med. 41, 500(1949)(in Swedish).

Investigations of 36 people employed in the production of vanadium pentoxide established a discrete syndrome of vanadium poisoning, which in the most extreme form consisted of sore throat, dry cough, chest rhonchi, dyspnea on exertion, palpitations, fatigue, lethargy, eye sores, and in some cases a papular rash on the extremities, but none of the patients showed green tongue discoloration. Experiments with animals showed that high concentrations of vanadium pentoxide cause rapid death in rabbits from pulmonary edema, or acute respiratory distress. Further experiments are in progress to demonstrate the effects of low concentrations in animals over long periods of time.

4512 Academy of Sciences Meeting of April 24, 1950. Gazette hôpitaux 123, 272(1950) May 13 (in French).

Among the papers presented was: The Differential Metabolism of Two Hemoglobins Studied in the Same Adult Animal by Means of Radioactive Iron, Georges Schapira, Jean-Claude Dreyfus, and Jacques Kruh. This paper concerns the separation of two fractions of different specific activity in the hemoglobin from erythrocytes in adult rabbits treated with radioactive iron.

4513 The Anemia of Infection. X. The Effect of Infection on the Absorption and Storage of Iron by the Rat. Clark J. Gubler, George E. Cartwright, and Maxwell M. Wintrobe. J. Biol. Chem. 184, 563-74(1950) June.

The results of the study of the iron uptake in three series of rats infected with Staphylococcus aureus are presented; the iron measurements were aided by the introduction of radioactive Fe^{55} and Fe^{59} into the rats during the experiments. The experiments are described in detail. It was found that there was a decrease in the total body retention of both nonradioactive and radioactive iron during the period of infection. 29 references.

4514 The Anemia of Infection. XI. The Effect of Turpentine and Cobalt on the Absorption of Iron by the Rat. Clark J. Gubler, George E. Cartwright, and Maxwell M. Wintrobe. J. Biol. Chem. 184, 575-8(1950) June.

The influence of turpentine-induced abscesses and of cobalt administration on the absorption of iron has been investigated in weanling male Sprague-Dawley rats by determining the total amount of radioactive iron retained in the body during the period of treatment. Turpentine was found to decrease the absorption of iron, and this effect could be reversed by the administration of cobalt. Cobalt administration did not significantly affect the absorption of iron in normal rats. (auth)

4515 The Anemia of Infection. XII. The Effect of Turpentine and Colloidal Thorium Dioxide on the Plasma Iron and Plasma Copper of Dogs. George E. Cartwright, Clark J. Gubler, and Maxwell M. Wintrobe. J. Biol. Chem. 184, 579-87(1950) June.

The intramuscular injection of 5 ml of turpentine into each of 10 dogs resulted in an average decrease in plasma iron of 77% within 24-48 hr. The intravenous injection of a single dose of colloidal thorium dioxide (2 ml/kg of body weight) into each of 13 dogs resulted in an average decrease in plasma iron of 29% in 24 hr. The administration of three consecutive daily intravenous injections of colloidal thorium dioxide into each of 9 dogs resulted in an average increase in the plasma iron of 446% within 3 to 7 days. The intramuscular injection of 5 ml of turpentine into each of 5 dogs previously given three consecutive daily intravenous injections of colloidal thorium dioxide resulted in an average decrease in plasma iron of only 18%. These studies suggested, to the authors, the possibility that the hypoferremia which follows the intramuscular injection of turpentine is the result of increased activity of the reticulo-endothelial system. 18 references. (auth)

4516 Determination of Circulation Rate with Radioactive Table Salt. P. Waser and W. Hunzinger. Cardiologia 15, 219-21(1949/50)(in German).

In order to investigate the hemodynamics of the heart and the peripheral circulation, radioactive salt ($Na^{24}Cl$) was injected into a vein of the right arm of a number of normal and diseased subjects and the radioactivity was measured at various places on the body (over the heart, extremities, etc.) for a variable period of time thereafter; the radiation intensity was charted as a function of time. Examples are given of the differences in circulation rates and volumes in various diseases and conditions such as mitral stenosis, hypertonic states and atypical pneumonia.

4517 Deuterium Studies in Normal Man. I. The Rate of Synthesis of Serum Cholesterol. II. Measurement of Total Body Water and Water Absorption. Irving M. London and D. Rittenberg. J. Biol. Chem. 184, 687-91(1950) June.

The rate of synthesis of serum cholesterol was determined and measurements of total body water and water absorption (with the aid of deuterium oxide) were made on a 22 year-old lean white male in excellent health. The serum cholesterol was determined by the Sperry-Schoenheimer method (The Schoenheimer-Sperry Method for the Determination of Cholesterol, New York (1945)). Deuterium was administered orally as a 10% solution of D_2O; in the first 48 hr of the experiment, 4,500 ml of 10% D_2O were given in 10 doses and for the following 21 days 180 ml of 10% D_2O were given daily

in single doses; the daily dosage for the final 18 days was 200 ml of an 11.5% solution. The deuterium concentration in body water was determined periodically by analysis of urine specimens. The half-life of serum cholesterol was found to be 8 days in this subject and the turnover time was 12 days. The total body water was found to be 72% of the body weight.

4518 Distribution of Tracer Carbon Among the Lipides of the Alga Scenedesmus During Brief Photosynthetic Exposures. K. A. Clendenning. Arch. Biochem. 27, 75-88(1950) June.

The tracer carbon found in the benzene-soluble fraction of Scenedesmus obliquus after 40-sec exposures to $C^{14}O_2$ is incorporated in nonvolatile water-insoluble compounds. The radioactivity of the "A" fraction does not result from trace contamination with water-soluble compounds. Chlorophylls a and b were obtained free of tracer carbon by successive purifications on sucrose columns. The chlorophyll was not separated from the tagged nonpigments on MgO and MgO—$Ca(OH)_2$ columns. After saponification, the "A"-fraction tracer carbon was distributed quite uniformly, in terms of specific activity, between the unsaponifiables, fatty acid, and water-soluble saponification products. Very little of the tracer carbon in these fractions was removed by lengthy steam distillation. Approximately equal amounts of tracer were recovered in the saturated and unsaturated fatty acid fractions which were separated by the lead salt-alcohol method. These indications of the rapidity of photosynthetic and other cell processes are discussed in relation to the known working periods of enzymes and the responses of photosynthesis to intermittent light. The different behavior of tracer assimilated in light and in darkness during subsequent dark metabolism is attributed to the initial distributions of tracer carbon among the three solvent fractions. 23 references. (auth)

4519 The Effects of Lipotropic Factors on Phospholipide Turnover in the Plasma of Normal Persons as Indicated by Radioactive Phosphorus. W. E. Cornatzer and David Cayer. J. Clin. Invest. 29, 534-41(1950) May.

The lipid phosphorus was determined on each member of one group of 13 normal healthy humans and on a second group of 6 normal healthy humans who each received a single 10-g dose of choline chloride (or its equivalent of choline dihydrogen citrate) or methionine (dl). Some of these took part in a repeat test at an interval of two months. All individuals were given an intramuscular injection of 0.5 μc of P^{32} as $NaH_2P^{32}O_4$; blood samples were taken at the time of administration and at 6, 24, 48, 72, and 96 hr after administration for determination of the active-phosphorus-containing fractions. Urine was collected for a 3-hr period at 21-24 hr after administration in some individuals. The results are tabulated in terms of the amount of P, the specific activity, and the relative specific activity. Some results are graphed against time and the data are extensively discussed. The authors conclude that phospholipid turnover, as measured in the plasma of normal persons, varies widely between individuals but is relatively constant in the same individual. Experiments on the same person with choline or methionine doses, repeated after two months in the same person without the choline or methionine,

show no significant differences between the two determinations. This may be interpreted to mean that the ordinary dietary supply of these lipotropic substances was adequate.

4520 Fatty Acid Synthesis by Enzyme Preparations of Clostridium Kluyveri. VI. Reactions of Acyl Phosphates. E. R. Stadtman and H. A. Barker. J. Biol. Chem. 184, 769-93(1950) June.

Enzyme preparations of Clostridium kluyveri catalyze a rapid reversible transfer of the phosphoryl group of monoacetyl phosphate to adenylic acid and adenosine diphosphate. The transfer to adenylic acid appears to be direct, since no myokinase activity could be detected. A quantitative chromatographic procedure was developed by which acyl phosphate derivatives of the lower fatty acids (2 to 6 carbon atoms) can be estimated in a mixture. By means of this method it was shown that enzyme preparations of C. kluyveri catalyze a transfer of the phosphoryl group of acetyl phosphate to fatty acids of 3 to 6 carbon atoms. These transphosphorylations are not mediated by the adenylic acid system. With molecular hydrogen as the reducing agent, acyl phosphate derivatives of propionate, butyrate, valerate, and caproate are reduced enzymatically to the corresponding alcohols. Evidence is presented that appears to eliminate butyryl phosphate from consideration as an intermediate in the synthesis and oxidation of caproate. In the presence of arsenate, the enzyme preparations catalyze a rapid and complete hydrolysis of acetyl phosphate to acetate and inorganic phosphate. This arsenolysis reaction is specific for acetyl phosphate; arsenate has little or no influence on the rate of decomposition of other acyl phosphates. Several types of evidence indicate that the arsenolysis reaction is catalyzed by an acetyl-transferring enzyme. P^{32} was used as a tracer in several of the experiments performed. 28 references. (auth)

4521 The Influence of the Corticotropic Hormone from Ox on the Active Salt Uptake in the Axolotl. Valborg Koefoed Johnsen and Hans H. Ussing. Acta Physiol. Scand. 17, 38-43(1949).

As a part of this study the true Na uptake was measured with Na^{24} in order to determine whether the net salt gain is due to an increased salt uptake, a decreased salt loss, or a combination of the two effects. The method used was the same as that applied to studies of active ion uptake through frog skin; in all cases the hormone injections resulted in an increase in Na uptake of several hundred per cent lasting for 1 to 5 days while the control animals showed only a short lasting pricking effect or no increase at all. The results are presented and discussed.

4522 Metabolism of Fatty Acids in Vitro, Studied with Odd and Even Members of the $RC^{14}OOH$ Series. R. P. Geyer and Mary Cunningham. J. Biol. Chem. 184, 641-6(1950) June.

Studies on the metabolism of carboxyl-labeled (C^{14}) pentanoic, hexanoic, heptanoic, octanoic, nonanoic, and dodecanoic acids, in vitro are reported. It was found that liver slices converted more radiocarbon to acetoacetic acid ($-C^{14}OOH$) than did the kidney slices, but the total C^{14} accounted for in this product and as respired $C^{14}O_2$ was similar for both tissues. The amount of $C^{14}O_2$ produced from the various substrates by liver was more uniform than was that of the acetoacetic acid ($-C^{14}OOH$) formed; the latter was higher for the even numbered acids than for the odd numbered ones. Malonic acid decreased $C^{14}O_2$ formation from all substrates by liver slices, but simultaneously increased acetoacetate ($-C^{14}OOH$) formation. (auth)

4523 Metabolism of the Thyroid Hormone in the Rat as Shown by Physiological Doses of Labeled Thyroxine. J. Gross and C. P. Leblond. J. Biol. Chem. 184, 489-500(1950) June.

Female albino rats, weighing 80 to 120 g and fed on Purina fox chow, were injected intravenously with doses of 0.001 to 20.0 γ of I^{131}-labeled thyroxine. The 20 γ dose was prepared from DL-diiodothyronine and was labeled in the 3′, 5′ positions; the others were obtained from the plasma of radioiodide-treated rats and consisted of L-thyroxine randomly labeled in any of the four iodine positions. The purity of the radiothyroxine, estimated by isotope dilution, averaged 92%. The organs and excreta were analyzed for total radioactivity 2, 24, and 72 hr after injection, and, in some cases, were fractionated by means of butanol into thyroxine-like and nonthyroxine fractions. Thyroxine was found to enter all of the organs investigated without being stored in any one. The highest concentrations were found in plasma, liver, and kidney, but a large proportion of the body thyroxine was present in muscle. The radioactivity decreased rapidly, with time, in all organs, although at a somewhat faster rate in the plasma than in liver, kidney, skin, brain, spleen, muscle, fat, and perhaps adrenals and pancreas; this difference could be accounted for by a transformation of thyroxine into butanol-insoluble metabolites in these organs. The turnover time of thyroxine was calculated and found to be about 25 to 35 hr in the rat. While thyroxine, administered in large doses, was to a great extent excreted in the feces as thyroxine-like material, tracer doses were excreted in both urine and feces, mostly in a nonthyroxine form. Less than 20% of the body thyroxine was excreted as such, the remainder being converted to its metabolites. The distribution of thyroxine was compared to that of the endogenous thyroid hormone in experiments with tracer radioactive iodide. At 2 hr after iodide injection, the radioactivity was found mainly in the stomach and urine in a butanol-insoluble form; after 24-72 hr, the organ radioactivity had a distribution similar to that of radiothyroxine. It is concluded that the results obtained with the smallest doses of labeled thyroxine indicated the pathways of metabolism of the endogenous thyroid hormone. (auth)

4524 Metastatic Adenocarcinoma of the Thyroid with Elevated Basal Metabolism: Radioiodine Studies. S. J. Weinberg, R. M. Fink, Kay Fink, and G. L. Packer. Ann. Internal Med. 32, 1207-23(1950) June.

A case of adenocarcinoma of the thyroid with evidence of hyperthyroidism and metastases to the liver, kidneys, bone, and other organs was observed following x-radiation and radioiodine administration. The external radioactivity measurements in the lower abdominal region were of the same order of magnitude as those over the thyroid 24 hr after the radioactive iodine had been given. Subsequently, this area was found to lose radioactivity at approximately the same rate as urine and plasma, in contrast to the prolonged retention exhibited by the thyroid. No therapeutically effective

concentrations of radioiodine could be demonstrated in the metastases. 25 references.

4525 Methods of Biological Investigation Using Radioactive Isotopes; the Relative Activity in the Ashes of Tissues. Gustave Joyet. Bull. Schweiz. Akad. Med. Wiss. 5, 361-404(1949) Dec. (in French).

Biological investigations with radioactive isotopes yield sufficiently accurate results if a certain number of technical problems inherent in the method are resolved beforehand. Equipment was built which enabled the study of the importance of absorption in radioactive samples consisting of layers of incinerated tissues where both soft and hard radiations are emitted. The equipment comprises a stabilized counter which is protected against pick-up and mounted in a thermostat, and which permits the geometry of sample to be accurately defined and perfectly reproduced. The relative activity of the radioactive solution which is injected and the activities of the various samples are measured in the same conditions of absorption emission, and scattering. For two isotopes K^{42} and Fe^{59}, the losses introduced when the organs are incinerated in quartz crucibles, using a fast and standardized mode of incineration at 700°, was determined. The slight differences in the absorption of a soft β-radiation by ashes derived from the different organs was also measured. The part played by radioactive impurities and the possibilities of eliminating them while preparing the active solution in an injectable molecular form is stressed. Finally the various calculations and corrections which are to be applied to the raw data are shown, and the presentation of the results emphasizing the idea that the "selectivity" of a tissue enables the determination of the concentration of the active substance in a way which is independent of the injected activity and the weight of the subject is stressed. 27 references. (auth)

4526 New Achievements in the Field of the Metabolism of Iron by Using a Radioactive Isotope. A. Vannotti, M. Closuit, and A. Jaccottet. Bull. Schweiz. Akad Med. Wiss. 5, 427-47(1949) Dec. (in French).

Studies were made on iron metabolism in rabbits in both normal and pathological conditions using Fe^{59} as a tracer. In chronic anemia, there is strong fixation of iron in the bone-marrow to the prejudice of deposit organs. In hypoxia (6000 m altitude) iron is also accumulated in the bone-marrow depending upon the degree of erythropoieses. Likewise, in hyperthyroidism, bone-marrow activity is important, but an augmentation of iron in the myocardium (only muscle in activity during the tests) was also found. Finally, in acute inflammatory conditions, a considerable drop of circulating iron and a strong fixation of this metal in bone-marrow and musculature are noted. Physico-chemical alterations of proteins are at the origin of these modifications. The spleen is of but secondary importance in the fixation of iron during hemolysis, while the liver remains the regulating organ of the intermediate iron metabolism, which is chiefly governed by the hematopoiesis needs, and but secondarily by the metabolic necessities of other tissues. These functional differences in the repartition of iron during the synthesis of hemoglobin and the other cellular hemes are also apparent in the variation of the rapidity with which iron-based pigments are formed. If hemoglobin formation can proceed very rapidly cellular heme compounds syntheses, especially that of cytochrome c, are much slower. 24 references. (auth)

4527 On the Synthesis and Some Applications of Serine-β-C^{14}. Melvin Levine and Harold Tarver. J. Biol. Chem. 184, 427-36(1950) June.

DL-Serine has been synthesized with C^{14} in the β-carbon; a description is given of the synthesis. A method of assay of the specific activity of the β-carbon of serine based upon the titrimetric determination of methylenebismethone has been developed. Tracer experiments with serine-β-C^{14} have been carried out in intact rats, the results of which show a rapid uptake of the serine by the tissue proteins and the appearance of the β-carbon in ethanolamine. These experiments support the hypothesis that the pathway of glycine to ethanolamine is via serine. 23 references. (auth)

4528 On the Use of Heavy Hydrogen in Biochemistry. Karl Bernhard. Bull. Schweiz. Akad. Med. Wiss. 5, 405-26(1949) Dec. (in German).

A survey is made of metabolism studies in which deuterium has been used as a tracer. The author's work with acetic acid, alcohol, and fatty acids, among others, is reported.

4529 On the Use of Radioactive and Non-Radioactive Isotopes in the Study of the Metabolism. Francesco Cedrangolo. Riv. biol. 41, 397-402(1949)(in Italian).

After having mentioned the principal results obtained in the chemistry of the metabolism by the use of the radioactive isotope technique, (among which the discovery of the high mobility and versatility of function of atoms and radicals, passing from organ to organ of a living body, is perhaps one of the most impressive), the author observes that important progress in biochemistry is still done by using less costly and often remarkably simple and convincing older methods. As an example, he cites his own studies on the transformation of fats into glycogen in vivo, and on the destiny of proline in the organism.

4530 The Origin of Protein Phosphorus Studies by Means of Radiophosphorus. Henri Simonnet, Paul Bonet-Maury, and Joseph Sternberg. Compt. rend. 230, 478-80(1950) Jan. 30 (in French).

Lactation was induced in a female goat after which 4 cc of a $Na_2H\ P^{32}O_4$ solution with an activity of 32×10^8 cts/min was administered subcutaneously in a single dose. Samples of milk, blood, and urine were taken over a 14-day period for analyses of different fractions in order to test the origin of P in casein and other P-containing compounds in the milk. The results in terms of counts per gram of sample for total P, protein P, and inorganic P are graphed against time; results in terms of counts per microgram of P are also graphed. The authors conclude that in this experiment inorganic P did not enter the phospholipids of the milk but it is utilized in the casein synthesis.

4531 The Oxidation of Palmitic Acid-1-C^{14} by Extrahepatic Tissues of the Dog. D. S. Goldman, I. L. Chaikoff, W. O. Reinhardt, C. Entenman, and W. G. Dauben. J. Biol. Chem. 184, 719-26(1950) June.

Palmitic acid-1-C^{14} was injected intravenously into normal and liverless dogs and its conversion to CO_2 was measured. Approximately 11% of the C^{14} was found to be expired as CO_2 in 7 hr by the normal dog, and about 4% in the same length of time by the liverless dog. Evidence is presented for the

view that less than 40% of the $C^{14}O_2$ exhaled by the normal dog could have resulted from direct oxidation of the labeled palmitic acid by all of its extrahepatic tissues. The extent of direct oxidation of higher fatty acids by extrahepatic tissues is discussed. 11 references. (auth)

4532 Phosphate Metabolism in Tooth Pulp Based on Studies of Radioactive Isotopes. J. F. Volker. Zahnärztl. Rundschau 9, 146-7(1949).

A review of the results obtained in dental research by the use of radioactive isotopes is presented. Phosphorus metabolism can be shown in the pulp, the periodontium and the saliva by the tracer method. This metabolism is influenced by age and species, is most distinct in the mouse and decreases in the rat, cat, dog, monkey, and man. In every species the phosphorus metabolism decreases with age.

4533 The Phosphorus Compounds of Sea Urchin Eggs and the Uptake of Radio-Phosphate upon Fertilization. Arthur H. Whiteley. Am. Naturalist 183, 249-67 (1949).

A compilation of the kinds and amounts of phosphorus compounds so far identified in sea urchin eggs is presented. The following problems involving these compounds are reviewed: the interrelations of desoxynucleic acid and ribonucleic acid, the uptake of P^{32} by fertilized and unfertilized eggs, the interchange of P among acid-soluble compounds at fertilization, the possible roles of propanediol phosphate and adenosine triphosphate in energy metabolism, and the ability of propanediol phosphate to modify morphogenesis.

4534 The Physical Basis of Isotopes. P. Scherrer and R. Steffen. Bull. Schweiz. Akad. Med. Wiss. 5, 319-30(1949) Dec. (in German).

This article briefly describes the concept of stable and radioactive isotopes and emphasizes the use of radioactive isotopes in medical and biological research.

4535 Progress in Biochemistry. Felix Haurowitz. New York, Interscience Publishers. 1950. 405p.

This book was written mainly to inform students and teachers of science, medicine, and pharmacy about the results of biochemical research since 1939. The first chapter briefly reviews the structure of stable and radioactive isotopes, and outlines the use of such isotopes as tracers in metabolism studies. Subsequent chapters deal in detail with various metabolism problems and discuss the use to which radioactive and stable isotopes have been put in this connection.

4536 Protein Turnover and Incorporation of Labeled Amino Acids into Tissue Proteins in Vivo and in Vitro. Henry Borsook. Physiol Revs. 30, 206-19(1950) Apr.

A general review is presented on the results of isotopic experiments concerning protein turnover and the incorporation of labeled amino acids into tissue proteins in vivo and in vitro. Separate sections are devoted to a discussion of plastein formation, protein turnover in vivo, amino acid incorporation in vivo, amino acid incorporation in vitro, the mechanism of amino acid incorporation, and the independent uptake of amino acids. The author states that experiments have shown that intact cells incorporate into their proteins

in vitro every labeled amino acid, both dispensible and indispensible, presented to them, that the rates of incorporation are of the same order of magnitude as in vivo, and that the concentration from which amino acids are taken up are within their range in the blood. Homogenates are less effective than intact cells, but, in the cases of liver and diaphragm, they can still take up amino acids. Any information gained from in vitro experiments on the mechanism of incorporation of amino acids into protein is to be considered as applicable in some degree to the process in vivo. The author concludes that labeled amino acids incorporated into a protein are bound in such a manner that either their carboxyl or amino groups are involved in the bond, probably by participation in peptide bonds, but the possibility of bonds of some other kind is not to be excluded. 68 references.

4537 A Quantitative Study of the Penetration of Radio-Thyroxine into the Hypophyseal Cells. R. Courrier, A. Horeau, M. Marois, and F. Morel. Compt. rend. soc. biol. 143, 935-7(1949) July (in French).

Intravenous injections of 5 to 1,200 gamma of thyroxine labeled with I^{131} and Na^{24} were administered to rabbits which were sacrificed 2 hr after injection. Blood samples were used as controls for determining the counts in the extracellular fluid; the specific activity of the dissected hypophysis was compared to the control values to determine the cellular specific activity; absorption in terms of the gamma per 1000 of thyroxine of 0.6 to 29 was noted with apparent saturation occurring when the thyroxine dosage was 250 gamma. The authors conclude that ionic I and thyroxine I penetrate hypophyseal cells in different ways and that thyroxine penetrates selectively.

4538 Radioactive Isotopes and Their Application to a Problem in Anaesthesia. Frank Howarth. Brit. J. Anaesthesia 22, 4-16(1950) Jan.

An extensive discussion is given of radioisotopes, their production, radioactivity, assay and assay corrections, choice of one for the particular problem which was the distribution and excretion of procaine administered as a spinal anaesthetic, and most of the rationale behind the conducting of a radioactive tracer experiment. One figure shows sections of the spinal cord of which radioautographs were taken.

4539 Radioactive Isotopes in Biological Experiment. W. P. Rogers. Roy. Australian Chem. Inst. J. & Proc. 17, 101-12(1950) Mar.

This article is a review of the properties of radioisotopes, the difficulties encountered in labeling complex compounds, their detection, the application of tracer methods, the treatment of diseases by radioisotopes, and the danger of radioisotopes to the laboratory worker. 26 references.

4540 Radioactive-Phosphorus Exchange Between the Grafted Part and the Stock of a Hybrid Plant. N. M. Sisakyan and V. Ya. Voronkova. Doklady Akad. Nauk S.S.S.R. 70, 275-7(1950)(in Russian).

Radioactive P was introduced into grafted hybrids of tomato plants, through infiltration of a water solution of sodium phosphate into the leaves of a branch of the grafted part; for this purpose, the end of the branch was enclosed in an evacuated flask containing the solution. After a few hours, the ac-

tivity of various parts of the whole plant was measured, and the results showed that the phosphorus exchange took place in the stock part of the hybrid as well as in the grafted part. The authors see in this finding a confirmation of Michurin's views on the close physiological interaction between the parts of a hybrid, and on the decisive part played by plastic somatic substances in the establishing of new breeds and varieties.

4541 Rate of Elimination of C^{14} Administered as $BaC^{14}O_3$. J. Govaerts. Science 111, 467-9(1950) Apr. 28.

After a brief review of previous work, experiments are described in which nine mice received intravenous injections of a fine suspension of $BaC^{14}O_3$ in isotonic glucose in order to deposit the barium carbonate in the lungs in a time determined by preliminary experiments. The animals were placed in metabolic cages for the duration of the experiments. Expirated CO_2, urine, and feces were collected and analyzed for counts. After the animals were sacrificed, the lungs, kidney, liver, and spleen were removed and prepared for assay using the Van Slyke-Foche method. The data are presented graphically and discussed; the author concludes that most of the C^{14} absorbed by the organism as barium carbonate is expired by the lung as $C^{14}O_2$, and that the dangers to those who work with C^{14} are not so great as expected.

4542 Recent Results of Metabolism Studies With the Help of Isotopes. Karl Bernhard. Bull. Schweiz. Akad. Med. Wiss. 5, 331-60(1949) Dec. (in German).

An account is given of recent uses of stable and radioactive isotopes in the study of many types of biological processes. Deuterium, C^{13}, C^{14}, N^{15}, S^{34}, and S^{35}, among others, have been applied with great advantage to difficult problems in intermediate metabolism. 116 references.

4543 The Relation of Folic Acid to the Metabolism of Serine. David Elwyn and David B. Sprinson. J. Biol. Chem. 184, 475-8(1950).

The utilization of L-serine and glycine containing N^{15} for hippuric acid formation has been studied in normal and folic acid-deficient rats. From the lower utilization of serine and the greater utilization of glycine in the deficient rats it was estimated that in folic acid deficiency the rate of conversion of serine to glycine is reduced to one-sixth of the normal value. A possible mechanism for the role of folic acid in the metabolism of serine is discussed. 20 references. (auth)

4544 The Relationship of Folic Acid to Formate Metabolism in the Rat. G. W. E. Plaut, Joseph J. Betheil, and Henry A. Lardy. J. Biol. Chem. 184, 795-805 (1950) June.

Rats were made deficient in folic acid by feeding a purified diet containing 2% succinyl-sulfathiazole. Three deficient rats were then given folic acid for four days while being pair-fed with three other deficient animals; all were then given $HC^{14}OOH$ intraperitoneally at a level of 160,000 cps/100 g of body weight and were sacrificed 3 hrs later. It was found that the folic acid-treated rats fixed about 10 times as much C^{14} into liver protein and 3 times as much into viscera protein as did the deficient rats. Amino acids were isolated from these proteins and it was found that the carbon of formate was predominantly incorporated into the β-carbon of serine; the specific radioactivity of the β-carbon of serine of the

folic acid-treated animals was much larger than that of those not treated; similar differences in C^{14} incorporation were also found in fractions containing aspartic and glutamic acids, arginine, and glycine. The difference in C^{14} content between samples of the two groups of animals is approximately 2:1 for the 1-carbon atom of glutamic acid, the carboxyls of aspartic acid, the guanidino group of arginine, and the respiratory CO_2, indicating a more rapid conversion of formate to CO_2 in the folic acid-treated animals. The influence of folic acid treatment on the radioactivity was still more pronounced on carbon atoms 2 and 3 of aspartic acid, the 4-carbon residue of decarboxylated glutamic acid, and the ornithine portion of arginine. The effect of folic acid on the fixation of C^{14} into these moieties is probably, the authors state, the result of its effect on the incorporation of C^{14}-formate into the β-carbon atom of serine. Heme from the blood of the folic acid-treated rats contained an appreciable quantity of C^{14}; that from the deficient rats contained none. The incorporation of C^{14} from formate into the β-carbon of serine was not influenced by biotin deficiency in rats.

4545 Relative Rates of Conversion of the Various Carbon Atoms of Palmitic Acid to Carbon Dioxide by the Intact Rat. E. O. Weinman, I. L. Chaikoff, W. G. Dauben, Mildred Gee, and C. Enteman. J. Biol. Chem. 184, 735-44(1950) June.

Palmitic acids labeled with C^{14} at their carboxyl, and 6 and 11 carbon atoms, respectively, were injected intravenously, in the form of their triglycerides, into fasted rats, and the expired CO_2 was collected at various time intervals. The location of the label on the palmitic acid chain did not influence significantly the amounts of the $C^{14}O_2$ expired or the rates of elimination of the $C^{14}O_2$. It is postulated that, once the process of breakdown of palmitic acid is initiated in the intact animal, a palmitic acid molecule is disrupted in such a manner that all of its carbons are converted to CO_2 at about the same time. The implication of these findings is discussed with regard to palmitic acid oxidation and the formation of lower chain fatty acids from palmitic acid. 14 references. (auth)

4546 Response by the Rat Thyro-parathyroidectomized at Birth to Growth Hormone and to Thyroxin Given Separately or in Combination. I. General Growth and Organ Changes. Robert O. Scow, Miriam E. Simpson, C. Willet Asling, Choh Hao Li, and Herbert M. Evans. Anat. Record 104(4), 445-63(1949).

Approximately 300 rats were thyro-parathyroidectomized at birth. They received injections of pituitary growth hormone and/or thyroxine from 31 to 61 days of age. At autopsy, completeness of the operation was determined by radioautography using I^{131} and block removal of the neck and the superior mediastinal tissue. It was found that during the injection period untreated controls increased in body weight from 34 to 49 g, total body length increased 12%, and bone age advanced 3 days. The rats receiving thyroxine, alone or with growth hormone, tripled their body weight; their body form, ears, pellage, and genitalia showed marked development; body length increased 17 to 18%; and their bone age advanced to 40 days. The rats receiving growth hormone alone doubled their body weight. However, their body form, ears, pellage, and genitalia remained immature as in the controls; their

body length increased 14%, while their skeletal age, like that of the untreated rats, advanced only 3 days. The nonendocrine viscera of the injected animals maintained proportionality to body weight with the exception of the brain and the eyeball. The endocrine and reproductive viscera developed only in rats receiving thyroxine. (auth)

4547 Results of Uptake and Excretion Tests With Radioiodine. T. H. Oddie, Brit. J. Rad. 23, 348-54(1950) June.

Tracer tests have been made on 24 patients with I^{131}. Uptake curves, obtained by external γ-ray measurements, and urinary excretion curves have been analyzed mathematically to find a suitable parameter for the diagnosis of toxic conditions of the thyroid. Evidence is given showing that the rate of release of organic iodine from the gland may be useful for this purpose. 11 references. (auth)

4548 The Role of Acetic Acid in the Biosynthesis of Heme. Norman S. Radin, D. Rittenberg, and David Shemin. J. Biol. Chem. 184, 755-67(1950) June.

The role of acetic acid in the synthesis of heme was investigated by means of the blood system of the duck in vitro and with the aid of compounds labeled with C^{14}. Carboxyl-labeled acetic acid, N^{15}-labeled glycine, methyl-labeled acetic acid, and C^{14}-labeled pyruvate, and other compounds were used. It was found that both the carboxyl and the methyl groups of acetate were used for heme synthesis. The carboxyl group of acetate is concluded to be a source of the two carboxyl groups of heme; it also contributes to at least four of the carbon atoms in the porphyrin molecule; these carbon atoms have a lower activity than the carboxyl carbon atoms. Hemin produced from methyl-labeled acetate was found to be six times as radioactive as that formed from carboxyl-labeled acetate of the same activity. It was shown that the methyl carbon was converted to the methyl and β-carbon atoms of the pyrrole as well as to other unidentified positions. Pyruvate was utilized for synthesis of heme; acetone and CO_2 were not. The data suggest to the authors that most or all of the carbon atoms of heme are derived from acetate and glycine. 12 references.

4549 The Role of Glycine in the Biosynthesis of Heme. Norman S. Radin, D. Rittenberg, and David Shemin. J. Biol. Chem. 184, 745-53(1950) June.

Glycine labeled with N^{15} and with C^{14} in either the carboxyl carbon atom or α-carbon atom was used to study the role of glycine in the biosynthesis of heme. It was found that the carboxyl carbon atom of glycine was not utilized for heme synthesis; 8 α-carbon atoms of glycine appeared to be utilized for the synthesis of the porphyrin molecule; for each nitrogen atom 2 α-carbon atoms of glycine were involved. Glycolic acid, iminodiacetic acid, pyruvic acid, serine, acetic acid, and formic acid were probably not involved in the utilization of glycine for heme formation. 23 references. (auth)

4550 The Role of Serine and Acetate in Uric Acid Formation. David Elwyn and David B. Sprinson. J. Biol. Chem. 184, 465-74(1950) June.

L- and D-serine labeled with C^{14} in the β-carbon atom, N^{15} in the amino group, and deuterium in the α and β positions were prepared. Following the administration to pigeons it

was shown that the β-carbon atom of L-serine is utilized for the ureide carbon atoms of uric acid to about the same extent as is the nitrogen for position 7; the incorporation into the ureide positions is about the same as that of formate; the utilization of serine nitrogen for position 7 is close to that of the α-carbon of glycine for position 5. A limited incorporation of C^{14} into position 5 took place following the administration of either L- or D-serine. The significance of these findings to the metabolism of serine, glycine, and formate, and the biosynthesis of uric acid has been discussed. The reported utilization of the carboxyl carbon of acetate for the formation of the ureide carbon atoms of uric acid could not be confirmed. 39 references.

4551 A Simplified Method for Measurement of Radioactive Corpuscle Samples for Blood Volume Determination. K. Zerahn. Acta Physiol. Scand. 16, 117-20(1948).

Radioactive corpuscle samples were transferred to cuvettes and measured by means of a common bell-shaped G-M counter; the cuvettes were made of a stainless steel ring, 3 mm thick, with a conical hole in the side of the ring, the ends of the ring being covered with circular cover glasses, 0.1 to 0.2 mm thick, which were sealed to the ring by picein. A cuvette may be filled with corpuscles or solution through the hole by means of a medical syringe.

4552 Site of Formation of Plasma Phospholipids Studied With C^{14}-Labeled Palmitic Acid. D. S. Goldman, I. L. Chaikoff, W. O. Reinhardt, C. Entenman, and W. G. Dauben. J. Biol. Chem. 184, 727-33(1950) June.

Palmitic acid-1-C^{14} was injected intravenously into both normal and hepatectomized dogs, and the recovery of labeled fatty acid in phospholipids of plasma and tissues was determined. Seven hours after the injection, about 2% of the C^{14} was found as phospholipid fatty acids of plasma in the normal dogs; about 0.1% was so recovered in the liverless dogs. The liver is, therefore, considered to be the principal site for the formation of fatty acid ester bonds of plasma phospholipid molecules. In the liverless dogs, isotopic fatty acids were recovered in the phospholipids of heart, skeletal muscle, kidney, small intestine and its mucosa, and lung. It is concluded that the failure of these tissues to deliver appreciable amounts of isotopic phospholipid fatty acids to the plasma of the liverless dogs demonstrates that, in this animal, the phospholipids synthesized by the tissues above are not normally concerned with the transport of fatty acids from one organ to another. (auth)

4553 Studies of the Fate of Radioactive 2,4-Dichlorophenoxyacetic Acid in Bean Plants. Robert W. Holley, Frank P. Boyle, and David B. Hand. Arch. Biochem. 27, 143-51(1950) June.

Carboxyl-labeled radioactive 2,4-dichlorophenoxyacetic acid (2,4-D) has been synthesized and applied to red-kidney bean plants. The distribution of radioactive carbon in the plants at various times after application of 2,4-D to the leaves indicates that the chief movement of radioactive carbon is downward in the stems. Radioactive carbon is lost from the plants as carbon dioxide and is also lost to the nutrient solution. A procedure has been derived which makes possible the isolation of nearly all the radioactive material

present in the stems of treated plants. Approximately one-third of the isolated radioactive material is 2,4-D. Over half of the isolated radioactive material is not 2,4-D, is water-soluble, and cannot be extracted by ether from an aqueous solution at pH 8.0 or pH 1.5. 12 references. (auth)

4554 Studies on the Mechanism of Protein Synthesis in Embryonic and Tumor Tissues. I. Evidence Relating to the Incorporation of Labeled Amino Acids into Protein Structure in Homogenates. Theodore Winnick. Arch. Biochem. 27, 65-74(1950) June.

Homogenates of fetal rat liver or mouse tumor were incubated with glycine or alanine labeled with C^{14} in the carboxyl group. The uptake of C^{14} by protein was several times as great as when homogenates of adult rat or mouse liver were employed. The turnover of glycine or alanine residues in the embryonic and tumor homogenates was of the order of 0.1 to 0.2%/hr. No C^{14} was released from any of the homogenate proteins by heating with ninhydrin. Following complete acid hydrolysis of the proteins, virtually all of the C^{14} was recovered as $C^{14}O_2$ upon ninhydrin treatment. This indicates that the C^{14} in the proteins was due to amino acids combined in peptide linkage. It was found that the protein from adult liver homogenate, incubated with labeled glycine, lost most of its C^{14} upon being dissolved in dilute alkali. The available evidence indicates that the C^{14} was concentrated in a labile peptide fraction, associated with the protein. Fetal liver and tumor homogenate proteins retained their C^{14} when treated with alkali. (auth)

4555 Studies on the Metabolism of Administered Cytochrome C by the Aid of Iron-labeled Cytochrome. Helmut Beinert. Science 111, 469-70(1950) Apr. 28.

Two male albino rats were injected intravenously with Fe^{55}-labeled cytochrome C and exposed immediately thereafter to a simulated altitude of 20,000 ft. Twenty-four hours after injection, about 10 ml of blood was drawn by heart puncture, and each animal was decapitated. Cytochrome was isolated from the kidney, heart, liver, and spleen. It appears from the recovery that no major site of radioactivity was missed in the investigation. The distribution of radioactivity suggests that injected cytochrome C is very rapidly disposed of by the body; none of the administered material was found intact with certainty after 24 hr; a large portion appeared in the urine. The kidney was the principal site of radioactivity remaining in the body. The author concludes that the low concentration of radioactivity in the plasma as compared with the red cells indicated a rapid breakdown of injected cytochrome. It is concluded that the beneficial action of cytochrome administration cannot be due to the known catalytic function of cytochrome in cellular metabolism and hardly to any other property in the intact cytochrome molecule itself unless a profound species difference would exist. 14 references.

4556 Studies with Radioactive Phosphorus on the Influence of Vitamin D on Phosphorus Metabolism in Young Pigs. Sam Nordfeldt. Kgl. Lantbruks-Högskol. Ann. 16, 114-26(1949).

These experiments were done with pigs seven days old and sacrificed on the tenth day. There were no symptoms of rickets; some diarrhea occurred when the 1500 I.U. vitamin

D supplement was fed, and the results were clearer when it was injected intraperitoneally. In the muscles, the P^{32} tended to decrease, while in the skeleton it increased more than 12%; in the kidneys, blood, feces, and urine there was no significant difference. The structure of the bone tended to be more compact when vitamin D was administered.

4557 Study of the Vasomotor Action of Short Waves [Electric] with the Use of Radioisotopes. Andre Strohl, Henri Desgrez, and Jean-Claude Roucayrol. Compt. rend. soc. biol. 144, 106-9(1950) Jan. (in French).

Rabbits were subjected to an electric shock lasting 25 min at an ankle (the voltage and frequency are not specified) and were then injected subcutaneously in the neck with a solution containing Na^{24}. The passage of the sodium through the body and into the paws was recorded with a Geiger counter. From an analysis of the data collected the following conclusions were made: (1) The paws situated farthest from the electrode undergo a reflex action of thermal origin. (2) Weak voltages cause a vasodilation which is greater on the side subjected to the voltage and lasts several weeks. (3) Strong voltages cause a vasoconstriction predominating at the side nearest to the electrode and lasting several days; this causes an apparent dilation at the opposite side. (4) The effect of short waves is not localized to the neighborhood of the point where the electrodes are attached.

4558 The Uptake in Vitro of C^{14}-Labeled Glycine, L-Leucine, and L-Lysine by Different Components of Guinea Pig Liver Homogenate. Henry Borsook, Clara L. Deasy, A. J. Haagen-Smit, Geoffrey Keighley, and Peter H. Lowy. J. Biol. Chem. 184, 529-43 (1950) June.

The synthesis and resolution of L-leucine and of L-lysine labeled with C^{14} in their carboxyl groups are described. Three different particulate fractions and a supernatant fraction of guinea pig liver homogenate were prepared by differential centrifugation; the four fractions exhibited functional differences in the rates at which they incorporated glycine, L-leucine, or L-lysine. L-lysine was incorporated into the proteins of the particulate fractions of guinea pig liver homogenate under one set of conditions and into those of the supernatant fraction under another set of conditions. When labeled glycine, L-leucine, and L-lysine together were incubated with a homogenate fraction, the uptake, as measured by the radioactivity of the protein, was the sum of that of the three amino acids incubated separately. Addition to the reaction mixture of a mixture of nonradioactive amino acids corresponding to the composition of casein did not affect the uptake of the labeled amino acids. $CuCl_2$ and $CoCl_2$ of concentration 0.005 to 0.0005M inhibited the incorporation into the proteins of glycine, L-leucine, and L-lysine; the inhibition was greater the higher the concentration of cobalt. $MnCl_2$ exerted neither a stimulation nor an inhibitory effect when used as 0.005 to 0.0001M strength. 23 references. (auth)

4559 The Use of Isotopic Nitrogen in a Study of the Conversion of 3-Hydroxyanthranilic Acid to Nicotinic Acid in Neurospora. Edgar Leifer, Wright H. Langham, Joseph F. Nyc, and Herschel K. Mitchell. J. Biol. Chem. 184, 589-92(1950) June.

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Further support for the conversion of 3-hydroxyanthranilic acid to nicotinic acid in Neurospora was demonstrated by a tracer experiment with ammonium chloride containing N^{15}. The experimental findings suggested to the authors the presence of a symmetrical diamino compound as an intermediate in the conversion since nearly half the nicotinic acid nitrogen was derived from $N^{15}H_3$ in the culture medium. (auth)

4560 Venous Catheterization of Dairy Cows. N. P. Ralston, Max Kleiber, and A. H. Smith. J. Dairy Sci. 32, 889-93(1949).

Polyvinyl chloride tubing was successfully used as a venous catheter for accurate injection of radioactive P^{32} and for frequent bleeding over a long period with a minimum of disturbance to cows. Nineteen catheters were used in 12 trials on 5 cows. Blood was obtained at the rate of 1 ml/sec through the catheters which remained open from 2.1 hr to 14.5 days. The technic of catheterization is described.

4561 Venous Velocity in the Leg Measured with Radioactive Sodium. J. Elliot Levi and Edward F. Lewison. Bull. John Hopkins Hosp. 86, 370-82 (1950) June.

A method for the determination of segmental linear venous velocity employing Na^{24} is presented. In a series of 40 normal subjects this velocity as measured from ankle to groin was found to be 3.8 ± 0.37 cm/sec. In this series 88% of the venous velocity determinations were 1.3 to 5.0 cm/sec with extremes of 1.3 to 13.0 cm/sec. Age and sex was not observed to influence the rate of flow. In 45% of these normal subjects Na^{24} was found to persist in the region of the midcalf following injections. This puddling phenomenon was not influenced by posture and exercise and in one case was observed 24 hr after injection. It is believed that this work will be helpful in the study of venous thrombosis. 25 references. (auth)

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4562 Quantitative Analysis of Hafnium-Zirconium and Tantalum-[Niobium] Systems by X-ray Fluorescence. L. S. Birks and E. J. Brooks. Naval Research Laboratory Report No. NRL-3720-35/20hu, Dec. 16, 1949. 10p. (AEC File No. NP-1371.)

The x-ray fluorescence analysis method was adapted to the determination of small amounts of hafnium in zirconium and tantalum in niobium. Curves of the relative intensity of spectral lines of Ta and Nb or Hf and Zr were plotted against per cent composition by using prepared standard compositions. As an example of the accuracy attainable, a 0.5 at.% Ta in Nb specimen was measured to ±0.02% or 4% of the amount of Ta present with a total counting time of about 3 to 5 min. (auth)

4563 Determination of Traces of Beryllium in Biological Material. F. W. Klemperer and A. P. Martin. Anal. Chem. 22, 828-31(1950) June.

This article describes a procedure for the detection of minute traces of beryllium in biological material. After destruction of organic material, the excess of calcium is precipitated as sulfate and beryllium is separated from the solution by precipitation with ammonia, together with iron

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phosphate which is added as a collector. Iron and other interfering cations are removed by electrolysis with a mercury cathode, and beryllium phosphate is then separated from the solution by ammonia precipitation using aluminum as a collector. Beryllium is estimated quantitatively by a flourimetric method with morin. The smallest amount of beryllium that can be detected reliably by this method is 0.05 μg. Because beryllium can be isolated from large samples, it can be determined quantitatively in concentrations of less than 1 part in 10^{10} parts of urine. (auth)

4564 A Modern Periodic Chart of Chemical Elements. John D. Clark. Science 111, 661-3(1950) June 16.

This spiral chart is a development of one published by the author in 1933 and recently modified (Seaborg et al, Life 26, 82(1949) May 16). Three types of subperiods are recognized, comprising those elements whose shells have been filled by s or p, d, and f electrons, respectively. The treatment of the lanthanides and actinides is rational and unforced.

4565 Intensity of X-ray Reflexion from Perfect and Mosaic Absorbing Crystals. F. B. Hirsch and G. N. Ramachandran. Acta Cryst. 3, 187-94(1950) May.

The variation of the integrated Bragg reflection of perfect absorbing crystals with the degree of asymmetry of the reflection, structure factor, and wavelength is studied theoretically and compared with that of ideally mosaic absorbing crystals. It is shown that the integrated reflection of a perfect crystal is always less than that of a corresponding mosaic crystal. If absorption is very large, or if the reflection is very asymmetric, the integrated reflection of the perfect crystal approaches asymptotically that of the mosaic cyrstal. Approximate formulas are given for the integrated reflection as a function of asymmetry of the reflection, structure factor, and absorption coefficient. It is suggested that accurate determinations of structure factors may be made by the use of asymmetric reflections for which the integrated reflection becomes more nearly independent of the texture of the crystals. 18 references (auth)

4566 Investigations on the Binary Systems of Boron with Chromium, Columbium, Nickel, and Thorium, Including a Discussion of the Phase "TiB" in the Titanium-Boron System. Lars Henrik Andersson and Roland Kiessling. Acta Chem. Scand. 4, 160-4 (1950).

Investigations on the binary systems chromium-, columbium-, nickel-, and thorium-boron are reported. The titanium-boron system is discussed, and it is shown that the phase "TiB," previously assumed to have zincblende structure, probably has a face-centered titanium lattice with boron in the octahedral interstices. In the chromium-boron system, the structure of the η phase has been determined. It has the composition Cr_3B_4 and is isomorphous with Ta_3B_4 and Mn_3B_4. Some data for the δ phase are also given. For the columbium-boron system, a phase analysis has been carried out. The structures of three of the intermediary phases, CbB, Cb_3B_2, and CbB_2 (with extended homogeneity range) have been determined. They are isomorphous with corresponding phases of the tantalum-boron system. A brief phase analysis of the nickel-boron system showed the existence of a phase with lower boron content than Ni_2B, which has not been pre-

viously reported. In the thorium-boron system a new phase, probably with a complicated structure, was found with a boron content of about 50 at. % (auth)

4567 The Infrared Spectra of Hydrogen and Deuterium Peroxides in Condensed Phases. Robert Cooper Taylor. J. Chem. Phys. 18, 898-9(1950) June. (Letter to the editor).

Preliminary work on the infrared absorption of liquid H_2O_2 and D_2O_2 at −30°C shows the low frequency band at 635 and 538 cm^{-1}, respectively, with a resulting H to D frequency ratio of 1.18. Crystalline H_2O_2 at −78°C showed the band resolved into three components one of which may be caused by lattice vibration. The assignment of the low frequency and other bands to particular vibrational modes is discussed.

4568 The Relative Rates of the Reactions of Hydrogen Iodide and Deuterium Iodide with Methyl Iodide. Thomas W. Newton. J. Chem. Phys. 18, 797-801 (1950) June.

The relative rates of the reactions of hydrogen iodide and deuterium iodide with methyl iodide were studied by a competitive method at 310° and 250°C. The analysis of hydrogen-deuterium mixtures was accomplished by means of a simple viscometer with an accuracy of 0.5%. It was found that hydrogen iodide reacts about 1.4 times as fast as deuterium iodide at both temperatures. These results are discussed in terms of Eyring's theory of absolute reaction rates and a simple model. (auth)

4569 Determination of the Fluoride Ion with Ferric Thiocyanate. R. S. Ingols, E. H. Shaw, W. H. Eberhardt, and J. C. Hildebrand. Anal. Chem. 22, 799-803(1950) June.

A study of the ferric thiocyanate complex indicates that the sensitivity of the complex toward the fluoride ion is dependent upon both total ion concentration and concentration of the ferric, thiocyanate, hydrogen, and sulfate ions. The concentrations of the first 3 of these 4 ions can be controlled by the amounts of reagents added in the test, while the concentration of the sulfate ion can be determined roughly by using a second color tube containing the sample and the same reagents plus zirconium oxychloride (3.0 mg in a 100 ml sample). The increase in the color of the ferric thiocyanate complex brought about by the zirconyl ion is a measure of the fluoride ion concentration. The sensitivity of the complex toward a given amount of fluoride is indicated by the difference between the color intensities of the sample plus zirconyl ions and the color of a tube of distilled water with ferric thiocyanate reagents. The full color intensity of the ferric thiocyanate complex develops instantaneously and is stable in the dark for several hours, though sensitive in blue light. The color does not change in hue, optical density values are reproducible, and sensitivity is similar to that of the zirconium alizarin technique. 12 references. (auth)

4570 Force Constants for the Fluoromethanes. E. L. Pace. J. Chem. Phys. 18, 881-4(1950) June.

A calculation, involving vibrational potential functions of a general quadratic type restricted to small displacements, has been used to evaluate force constants, singly or in linear combination, for the fluoromethanes and, simultaneously, to

confirm new assignments of the fundamentals of CF_3H and CF_2H_2 arising from a detailed experimental study of their Raman spectra. The results indicate considerably greater bond strengths than expected from a mere extrapolation of the properties of analogous halogen derivatives. Particularly significant is the order of interaction terms involving the C-F stretching and the F-C-F bending motions of the molecules. (auth)

4571 Infrared and Raman Spectra of Fluorinated Ethylenes. III. Tetrafluoroethylene. J. Rud Nielsen, Howard H. Claassen, and D. C. Smith. J. Chem. Phys. 18, 812-17(1950) June. (See also NSA 4-3700.)

The infrared absorption spectrum of gaseous tetrafluoroethylene between 2 and 22 μ has been investigated with a prism spectrometer of high resolution, and the region from 20 to 37 μ has been surveyed with a KRS-5 prism. The Raman spectrum of C_2F_4 gas has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A, and semiquantitative polarization measurements have been made. All of the 12 fundamental vibration frequencies have been determined, although with some uncertainty for three frequencies obtained from combination bands. The spectra are interpreted in detail. (auth)

4572 The Raman Spectrum of Vinylidene Fluoride. Walter F. Edgell and Willis E. Byrd. J. Chem. Phys. 18, 892-5(1950) June.

The Raman spectrum of vinylidene fluoride has been obtained in the liquid state at −100 to −125°C. The observed frequencies were assigned to the fundamental modes of vibration (and several combinations of these) with the aid of the infrared data in the literature supplemented by some measurements in our laboratory. A normal coordinate treatment of the vibrations has been carried out using a simple valency force field plus one additional term depending upon the square of the change in the F-F distance. It is shown that the repulsion between the F atoms and between each F atom and the π-electrons of the double bond are of major importance.

4573 Vibrational Spectra of Some Fluoromethanes. D. H. Rank, E. R. Shull, and E. L. Pace. J. Chem. Phys. 18, 885-7(1950) June.

Depolarization measurements have been made on the Raman spectrum of fluoroform and difluoromethane. Several new lines were observed, all of which had previously been found in infrared absorption. Several weak lines reported previously could not be found and presumably must be ascribed to impurities in the material used by earlier investigators. The analyses given for the vibration spectra now seem to be in plausible agreement with all the known spectroscopic data on these molecules. (auth)

4574 Investigation of the Possibilities of a High Frequency Induction Furnace for Fusing Sodium Fluoride Beads in the Fluorimetric Determination of Uranium in Ores. J. B. Zimmerman. Department of Mines and Technical Surveys (Canada) Topical Report No. 46/50, Apr. 17, 1950. 4p. (AEC File No. NP-1475.)

The following conclusions were determined by the investigation: (1) a 5 kw furnace is required to fuse 6 beads; (2)

beads must be fused in an inert atmosphere; (3) a considerable amount of experimental work would be required to produce a satisfactory work coil; (4) line voltage stabilization would be expensive; and (5) operating costs would be low.

4575 Action of Anti-Oxygens on the Radioformation of Hydrogen Peroxide. Jean Loiseleur. Compt. rend. 230, 1901-2(1950) May 22 (in French).

Experiments have shown that the presence of an anti-oxygen, such as the oxychloride of carbon exerts an inhibiting influence on the formation of hydrogen peroxide by x-irradiation.

4576 The Direct, Indirect, and Competitive Influence of Ionizing Radiation on the System Arsenite-Arsenate. Marc Lefort and Moïse Haissinsky. Compt. rend. 230, 534-6(1950) Feb. 6 (in French).

The establishment of a relationship is attempted between the oxidizing action of α and x-rays on the one hand, and the amount of energy absorbed, the concentration, and the pH of the arsenite solution on the other hand. Furthermore, an explanation of the reducing effect of the above rays on the system arsenite-arsenate is attempted.

4577 Stability of Color Centers in Alkali Halides. Ruth Casler, Peter Pringsheim, and Philip Yuster. J. Chem. Phys. 18, 887-91(1950) June.

Color centers have been formed in alkali halide crystals (KBr, KCl, NaCl, LiF) by exposing them to x-rays, electron bombardment, and pile irradiation; and their stability with respect to temperature and light bleaching has been investigated. In general such crystals contain centers of nonuniform stability. The lower the temperature at which the color centers have been produced, the more unstable they are on the average. In the absorption spectra taken at low temperature of crystals irradiated at low temperature new bands appear on the short wavelength side of the F-band which are never observed in crystals irradiated at room temperature and which, on warming the crystal to room temperature, vanish together with a part of the F-centers. It is suggested that the instability of some of the color centers formed at low temperature is connected with the presence of these new absorption bands. (auth)

4578 Valences of Radiophosphorus Obtained by Neutron Irradiation of Colored and Decolorized NaCl Crystals. Pierre Süe and Roger Caillat. Compt. rend. 230, 1864-5(1950) May 22 (in French).

The authors had found (Compt. rend. 230, 1666(1950)) that P^{32}, formed from chlorine during the irradiation of NaCl crystals with neutrons, has various valences, viz. 5 and < 5, when extracted. It was thought that the nuclear reaction actually results in the formation of P^{32} of various valences, but that the ratio of the products thus formed could be artificially modified if advantage was taken of the presence of traces of coloring substances in the original crystals; it can be surmized that the coloring centers in the crystal lattice, when decolorized by heating, liberate electrons that may be captured by the phosphorus ions, thus increasing the number of $P^{<+5}$ ions. The experiment confirmed this speculation. One half of an irradiated monocrystal was decolorized by a few-minute heating at 350°C, while the other half was not so treated. The results showed that, whereas in the original

colored crystal the average proportion of ions P^{+5} in the sum $P^{+5} + P^{<+5}$ was 43%, after decolorizing the proportion was 32%. These findings point to the necessity of taking into account the treatment to which an irradiated substance has been subjected, when determining the valence of the radioactive element obtained.

4579 The Distribution of Europium (II) Ions Between a Solid Phase and a Fused Salt Solution. Jerome Prener. J. Am. Chem. Soc. 72, 2692-5(1950) June.

The distribution of europium (II) between strontium sulfide or selenide and a liquid phase consisting of fused strontium chloride containing dissolved strontium sulfide or selenide and varying amounts of strontium oxide has been investigated. The distribution is less sensitive to strontium oxide than is the distribution of cerium and samarium. A thermodynamic treatment indicates that the distribution of a divalent ion similar in size to strontium should be independent of composition changes in the liquid phase. Thus the results on the distribution of europium in these systems are in accord with chemical evidence which indicates that europium (III) ions are reduced to the divalent state by sulfide and selenide ions and are thus incorporated into the strontium sulfide or selenide lattice. The equilibrium constant, K_T, decreases slightly with increasing temperature and is somewhat lower for higher europium concentrations. 11 references. (auth)

4580 A New Series of Ferromagnetic Bodies: the Ferrites of Rare Earths. Hubert Forestier and Georges Guiot-Guillain. Compt. rend. 230, 1844(1950) May 22 (in French).

The authors list a new series of ferromagnetic compounds having the formula $Fe_2O_3.MO$, where M is one of the rare earths La, Pr, Nd, Sm, Er, and Y. Their curie point and curves showing the variation of magnetization with temperature are included. The magnetization of these compounds when heated above the curie point is discussed.

4581 Spectra of Rare Earths in Solutions Fluid at the Temperatures of Liquid Nitrogen. Simon Freed and C. J. Hochanadel. J. Chem. Phys. 18, 780-2(1950) June.

Bands present in absorption spectra of rare earth solutions at room temperature are found to be resolved into lines at the temperature of liquid nitrogen. To prepare solutions which would remain fluid, the rare earth salt was first dissolved in a solvent which is liquid at room temperature, such as n-propyl alcohol or di-n-propyl ether. Pairs of low melting hydrocarbons such as methane, propane, propylene, butene-1, and iso-pentane were then condensed into the solution after the temperature had been sufficiently reduced. A number of combinations gave solutions which were homogeneous and fluid at the liquid nitrogen temperature. One of the solvents remained fluid to about 5° below the freezing point of nitrogen. Some hexahydrated rare earth nitrates and bromides were found to have solubilities at 77°K sufficient for obtaining spectra through light-paths of 25 cm. The spectra were comparable in sharpness with those from crystals of rare earths at low temperatures. Since the bands arising at room temperature were resolved into discrete lines at the low temperature, the possibility is open to investigate the symmetries and intensities of the electric fields about the positive ions in solution. Corresponding groups in the spectra

from the nitrates and bromides consisted of different numbers of lines of widely different spacing. In neodymium nitrate there was a marked transformation in the structure of the spectrum when the temperature of the solution was changed from 193°K to 77°K. At 77°K there was no change observed throughout nine days. The change with temperature was especially striking in the spectra of samarium bromide. Electrical conductances of some of the solutions were measured at 193°K and 77°K. The magnitudes were very low and strongly dependent on viscosity. (auth)

4582 The Separation of Thorium and Rare Earth Salts by Solvent Extraction. G. F. Asselin, L. F. Audrieth, and E. W. Comings. J. Phys. and Colloid Chem. 54, 640-8(1950) May.

Rare earth chlorides are extracted very slightly from aqueous solutions by 1-butanol and no separation is feasible under these conditions. Rare earth and thorium nitrates are extracted to a significant extent from aqueous solutions by 1-butanol. The order of decreasing extractability is given by neodymium through ytterbium and then thorium. Rare earths are extracted to a reasonable extent by 1-pentanol from aqueous solutions containing ammonium thiocyanate. Thorium is so much more extractable than any of the rare earths that a simple, very effective means of separating thorium from the rare earths is thereby afforded. Cerium usually present in natural thorium ores must be reduced to the trivalent state prior to the addition of thiocyanate. The more basic rare earths are the most difficult to separate from thorium in the preceding process. Single-step extractions of synthetic neodymium-thorium mixtures were carried out at two fixed thiocyanate concentrations and very good separations were obtained. No marked difference in selectivity for one thiocyanate concentration over the other was found to exist. The equilibrium distribution of thorium between water and 1-pentanol is influenced by the presence of neodymium and vice versa. Therefore, distribution curves for the pure materials cannot be used to predict accurately the behavior of mixtures, although they may be used as first approximations. (auth)

4583 A Labeled Carcinogenic Azo Dye; 3′-Methyl (C^{14})-4-Dimethylaminoazobenzene. David A. Salzberg, William Nye, and A. Clark Griffin. Arch. Biochem. 27, 243-4(1950) June. (Letter to the editor).

This article describes the synthesis of 3′-methyl (C^{14})-4-dimethylaminoazobenzene to be used in future studies of the mechanism of azo dye carcinogenesis. Eleven grams of bromobenzene was reacted with 1.6 g of magnesium to form phenylmagnesium bromide, which was then exposed to $C^{14}O_2$, resulting in carboxyl-labeled benzoic acid. The benzoic acid was esterified with methyl alcohol and nitration was effected resulting in 5.4 g of m-nitromethyl benzoate with an over-all yield of 50%. Reduction of the m-nitromethyl ester to m-toluidine was accomplished using hydrazine as a reducing agent yielding 0.4 g of 3′-methyl-4-dimethylaminoazobenzine containing 0.2 mc of C^{14} activity.

4584 Synthesis of C-14 Carboxyl-labeled Tyrosine and Diiodotyrosine. Robert Berner Loftfield. J. Am. Chem. Soc. 72, 2499-2500(1950) June.

Anisaldehyde was treated with ethyl chloroacetate in a solution of sodium in a mixture of ethanol and methanol.

The mixed ester derived from this was hydrolyzed by a solution of sodium hydroxide in methanol and ether. The product of this reaction was treated with weak acids and yielded sodium glycidate which was then dissolved in sodium bisulfite in water. Tyrosine was prepared from the resulting product by the Bucherer hydantoin synthesis (J. prakt. Chem. 140, 2, 291; 141, 5(1934)) followed by hydrochloric acid hydrolysis. The tyrosine yielded diiodotyrosine when treated with iodine and potassium hydroxide according to the method of Wheeler and Jamieson (Am. Chem. J. 33, 365(1905)). 11 references.

4585 Synthesis of L- and D-Glutamic Acid-1,2-C^{14}. 13. Information about the Chemistry of Tumors. F. Kögl, J. Halberstadt, and T. J. Barendregt. Rec. trav. chim. 68, 387-96(1949)(in German).

Starting from radioactive barium carbonate, dimethyl oxalate was obtained via $NaHCO_3$, Na formate, Na oxalate, and Ag oxalate. Condensation with dimethyl succinate and splitting with HCl led to the synthesis of α-ketoglutaric acid, which was converted into DL-glutamic acid-1,2-C^{14} by reductive amination; the radioactive antipodes were obtained with ease by fractional crystallization after adding the corresponding "light" antipodes; the determination of the radioactivity of the products was done after conversion into $BaCO_3$.

4586 Electrolytic Properties of Aqueous Solutions of Polyacrylic Acid and Sodium Hydroxide. I. Transference Experiments Using Radioactive Sodium. John R. Huizenga, Philip F. Grieger, and Frederick T. Wall. J. Am. Chem. Soc. 72, 2630-42(1950) June.

An investigation of the system polyacrylic acid-sodium hydroxide, with water as solvent, has been made by transference experiments using radioactive sodium tracer (Na^{22}) to determine the total flow of sodium. Measurements were made over the range 0 to 100% neutralization at two stoichiometric acid concentrations, namely, 0.0151 and 0.0378N, and at 61.7% neutralization for an acid concentration of 0.1189N. A considerable fraction of the sodium ions are associated with polymer over most of the range; about one-fourth of them at 25% neutralization and about two-thirds of them at 100% neutralization. The fraction of sodium ions associated increases monotonically with increase in neutralization at constant acid concentration. However, at constant neutralization, this quantity appears to decrease slightly with increase in acid concentration over the sixfold range investigated. Over the range 25 to 100% neutralization the fraction of the current carried by polyacrylate ion is surprisingly high and roughly constant (0.4 to 0.5). With increase in neutralization, the charge and size of the polymer ion increase, and the equivalent conductance of the polymer ion goes through a maximum in the neighborhood of 60% neutralization. With increase in acid concentration over the range 0.015 to 0.12N, the charge and number of sodium ions on the polymer ion remain practically constant, but the polymer ion mobility decreases appreciably. The effect of finite ion exchange on transference experiments is briefly considered. 11 references. (auth)

4587 Exchange Iodide-Polyiodide and Determination of the Constitution of Polyiodides with Radioactive Tracers. Dora Peschanski. Compt. rend. 230, 85-7 (1950) Jan. 2 (in French).

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A faster and simpler method than the volumetric analysis for the determination of the constitution of polyiodides is presented. This method is based on the exchange of iodine by I^{131}.

4588 Isotopic Exchange of Phosphorus Between the Phosphate Ion and Phosphoric-Acid Esters. A. F. Lukovnikov, V. P. Medvedev, M. B. Neĭman, A. N. Nesmeyanov, and I. S. Shaverdina. Doklady Akad. Nauk S.S.S.R. 70, 43-5(1950)(in Russian).

A study of P exchanges between PO_4^{-3} ions and $(RO)_3PO$ esters is important for the understanding of the animal phosphate assimilation. Several writers, using various esters, proved the absence of such an exchange at temperatures up to 100°C. The present authors experimented at 100-300°C, using sealed quartz ampuls. The phosphate ion was P^{32} labeled; the mixtures were heated for 20-30 hr in the presence of absolute dioxane, the volumes used being 5 ml with a P content 0.02 to 0.03 g. The following esters were investigated: tricresyl phosphate $(CH_3.C_6H_4O)_3PO$, tributyl phosphate $(n\text{-}C_4H_9O)_3PO$, triisobutyl phosphate $(i\text{-}C_4H_9O)_3PO$, trihexyl phosphate $(C_6H_{13}O)_3PO$, and triethyl phosphate $(C_2H_5O)_3PO$; the first one was heated with $H_3P^*O_4$, all the others with $Na_2HP^*O_4$. As a result, no P exchanges were observed. Consequently, the R—O bond is strong up to 290°, at which temperature the esters begin to decompose.

4589 Radiochemical Test of Orthophosphate-Pyrophosphate Separation. H. van der Straaten and A. H. W. Aten, Jr. Rec. trav. chim. 69, 561-4(1950) Mar.

A radiochemical technique was used to determine the efficiency of separation of pyrophosphate from orthophosphate by precipitation as zinc pyrophosphate (Travers and Chu, Helv. Chim. Acta 16, 913(1933)) compared to that obtained by precipitation as cadmium pyrophosphate (Hull, J. Am. Chem. Soc. 63, 1271(1941)). Each method was tested in two series of experiments, one with radioactive orthophosphate and inactive pyrophosphate, and the other with ordinary orthophosphate combined with labeled pyrophosphate. It was found that both methods of separation are equally satisfactory.

4590 The Separation of Americium and Curium from the Rare Earth Elements. Kenneth Street, Jr., and Glenn T. Seaborg. J. Am. Chem. Soc. 72, 2790-2 (1950) June (Notes).

Elution of Am, Cm, Lu, and Pm with ammonium citrate, 2M ammonium nitrate and various concentration of hydrochloric acid, hydrobromic acid, and perchloric acid in a resin ion exchange column was performed. The concentration of the acid strongly influenced the time of elution of the Am and Cm with respect to the rare earths. It is suggested that in addition to the interactions which the rare earths show with chloride ion, Am and Cm form weak covalent coordination complexes involving large numbers (6) of chloride ions with the covalent complex ion of Am slightly more stable than that of Cm. Elution rates were determined by using tracer quantities of Am^{241}, Cm^{242}, Pm^{147}, and Lu^{172}.

4591 A Summary of the Heavy Atomic Nuclei. W. Seelmann-Eggebert. Rev. Union Matemat. Arg. 14, 125-34(1950)(in Spanish).

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This is a recapitulation of the discovery of the transuranic elements up to and including curium. The four radioactive series 4n + x (x = 0,1,2, and 3) are illustrated.

4592 Coordination Compounds of Uranyl Nitrate. George W. Watt and Albert R. Machel. J. Am. Chem. Soc. 72, 2801(1950) June (Notes).

This article describes an attempt at preparation of anhydrous uranyl nitrate by dissolving uranyl nitrate 2-hydrate in anhydrous methyl isobutyl ketone. However, a monohexone solvate of uranyl nitrate was obtained. A short description is given of the method of preparing other coordination compounds of uranyl nitrate from uranyl nitrate 2-hydrate by using: (1) hexamethylenetetramine dissolved in ethanol, (2) excess ethylenediamine, and (3) ethylenediamine in the presence of phosphate ion.

4593 Intensity Relationships in the A and B Bands in the Absorption and Fluorescence Spectra of Some Uranyl Salts at Various Temperatures. D. D. Pant. Proc. Indian Acad. Sci. 31, 103-6(1950) Feb.

The author made a spectographic analysis of the absorption and fluorescence spectra of uranyl sulfate and uranyl fluoride II according to a method described previously (Proc. Ind. Acad. Sci. 22, 95(1945)). The intensities of the various bands of the spectra were obtained at a number of different temperatures ranging from −185°C to 25°C.

4594 On the Crystal Structure of KUO_2VO_4 (Synthetic Anhydrous Carnotite). Ingrid Sundberg and Lars Gunnar Sillén. Arkiv Kemi 1, 337-51(1950).

The two important uranium ores, the vanadates carnotite (Colorado and Utah) and tjujamunite (East Turkestan) have the accepted composition $K(UO_2)VO_4(H_2O)_{1.5}$ and $Ca_{0.5}(UO_2)VO_4\text{-}(H_2O)_2$, respectively; however, the water content may vary, and K and Ca ions may partially replace each other. The authors established the crystal structure of a synthetic anhydrous carnotite $K(UO_2)VO_4$, prepared by melting together K_2CO_3, V_2O_5 and $UO_2(NO_3)_2$. The x-ray analysis of the yellow monoclinic plates resulted in the following interpretation of the crystal structure: VO_4^{-3} tetrahedra, intermingled with linear UO_2^{+2} groups, form together layers of $UO_2VO_4^-$; these are separated by sheets of K^+. It seems probable that the same fundamental scheme underlies the structure of natural carnotite.

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4595 Handbook of Industrial Radiology. J. A. Crowther, Ed. London, Edward Arnold & Co., 1949, 2nd ed. 218p.

This second edition of the Handbook has been revised to incorporate advances since the appearance of the first edition in 1944. It provides a wide survey of industrial radiography by specialists writing on the following aspects: The physical principles, the requirements in design of industrial x-ray equipment, quantitative measurements, response of photographic materials to x-rays, the radiography of heavy metals, the radiography of light metals, gamma-radiography, some uncommon applications, and x-ray protection. The extensive bibliographies have been brought up to date by the addition of references to relevant literature

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published subsequent to the first edition. A table of linear absorption coefficients for 30 elements for the various K-α x-radiations has been added.

4596 Radioactive Isotopes in Timber Preservation Studies. Bell Labs. Record 28, 249-51(1950) June.

Exploratory studies are reported in which liquid movement through wood was revealed by tracer activity. To learn how water and preservatives disperse in telephone poles, specimens were impregnated with solutions of strontium chloride, labeled with Sr^{89} and Sr^{90}, and sliced with a microtome for radiography and Geiger counting. A curve showing counts versus radial distance from the surface of the timber decreased through the sapwood to zero at the periphery of the heartwood, with a temporary increase just before the latter.

4597 Radioactive Tracers in Flow Tests. Ralph S. Archibald. J. Boston Soc. Civil Engrs. 37, 49-116(1950).

The γ rays from I^{131} in the form of NaI were used to investigate the flow of water in pipes. A description of the technique of counting, estimating the probable errors, calibration of the tube, the operation of a counting rate meter employed in these experiments, etc., is given. For a laboratory setup counting was effected by placing the Geiger tube close to the outside of the pipe at various points after the NaI^{131} was introduced. A comparison of the results with theory is made. Field tests on the flow in a sewer pipe were made. Samples were taken and counted in the laboratory as counting in the field introduced large errors because of the voltage fluctuations in the counting equipment. About 3 mc of I^{131} was used in each sewer test. NaI^{131} was used also to investigate the properties of settling tanks on a laboratory scale as well as in the field. 11 references.

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4598 Radioactivity Survey in Southwest France. E. N. Tiratsoo. Bull. Am. Assoc. Petroleum Geol. 34, 742-54(1950) Apr.

This paper describes an investigation carried out by surface radioactivity measurements in southwestern France in one part of the Aquitaine sedimentary basin. This survey led to certain corrections in the accepted geological boundaries of the area.

4599 Alloys for High-Temperature Service; Quarterly Progress Report. Howard C. Cross. Battelle Memorial Institute, Dec. 16, 1949. 28p. (AEC File No. NP-1417.)

This report summarizes the work done during September through November 1949. In the investigation of chromium-base alloys, the effects of variations in melting and casting practices, chemical composition, and heat treatment on room-temperature shock resistance are being studied. Sixty heats have been prepared and tested in bending. The load-deflection curves for all of the alloys tested were straight lines and showed no evidence of plastic deformation. Two factors, grain size and oxygen content, appeared to be related to the maximum bending stress (in tension). The maximum bending stress tended to vary inversely as the logarithm of the grain size. For a given grain size, alloys

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containing more than 0.06% oxygen generally broke at higher maximum bending stresses than those with lower oxygen contents. The alpha-beta transformation in the cobalt-chromium-tungsten and cobalt-chromium-molybdenum alloys was blocked in. The transformation in these alloys is now being accurately determined. Binary cobalt-chromium alloys are being tested in creep rupture. Thirty-nine cobalt-chromium-nitrogen alloys were cast for the study of the effect nitrogen and microstructure on the rupture properties of cobalt-chromium alloys.

4600 Liquid Metal Heat Transfer Fluid Unstressed Static Corrosion Tests. J. L. Everhart and E. L. Van Nuis. American Smelting and Refining Company Report No. N-3, Mar. 20, 1950. 19p. (AEC File No. NP-1497.)

Unstressed static corrosion tests at 1200°F in liquid bismuth-lead, bismuth-lead-tin, and bismuth-indium-lead alloys were run on 17 constructional materials. The severity of attack was determined qualitatively by means of microscopic examination. High chromium irons and similar alloys modified with aluminum and cobalt were the most resistant of the materials tested. (auth)

4601 The Properties of Some Magnesium-Lithium Alloys Containing Aluminum and Zinc. Robert S. Busk, Donald L. Leman, and John J. Casey. J. Metals 188, 945-51(1950) July.

The mechanical properties and the phase-temperature relationships of Mg-Li-Al, Mg-Li-Zn, and Mg-Li-Al-Zn alloys are presented. The Li increases the workability in these alloys by producing the cubic phase. It is shown that the strengths of some of these alloys can be tripled by heat treating and aging but that the high strength is accompanied by brittleness and lack of stability.

4602 Description and Synthesis of the Selenide Minerals. J. W. Earley. Am. Mineral. 35, 337-64(1950) May-June.

A study of natural and artificial selenides, mainly by microscopic and x-ray methods, has led to revised descriptions of the selenide minerals. The mineral descriptions contain some new measurements of specific gravity, new unit cell dimensions (notably for eucairite, crookesite, and umangite), together with x-ray powder data for all the species and reproductions of the patterns. The classification of the selenides given in Dana(1944) is modified by the addition of a tetragonal group to the A_2X type, and the recognition of an $A_{2-x}X$ type. (auth)

4603 Metamict Pitchblende from Goldfields, Saskatchewan, and Observations on Some Ignited Pitchblendes. C. E. B. Conybeare and R. B. Ferguson. Am. Mineral. 35, 401-6(1950) May-June.

Seven metamict pitchblendes, apparently the first to be reported, are described from three localities in the Goldfields area of Saskatchewan. The changes in x-ray powder pattern and color of the powder after ignition are tabulated for these and two other pitchblendes; the principal changes are the restoration of the structure of metamict specimens and the occasional development of U_3O_8 with, or in place of UO_2. On the basis of these changes the 9 pitchblendes examined are classified into 5 distinct types.

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4604 X-ray Diffraction Data on Some Radioactive Oxide Minerals. Ronald J. Arnott. Am. Mineral. 35, 386-400(1950) May-June.

X-ray powder photographs and specific gravity determinations of specimens belonging to the uraninite-thorianite series and the pryochlore-microlite series gave, for the former, a = 5.403 to 5.575 A, G = 6.43 to 9.55 A, and for pyrochlore-microlite, a = 10.296 to 10.441 A. Indexed powder data are given for uraninite and for ignited microlite. The powder pattern of orthorhombic euxenite (ignited at 1000°C), is interpreted with the aid of established morphological descriptions. An indexed powder pattern is given. The latter two minerals are termed metamict since they show external crystalline form but are amorphous to x-rays. Heating to a glow restores the crystalline behavior.

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4605 The Formation of a Blast Wave by a Very Intense Explosion. I. Theoretical Discussion. Geoffrey Taylor. Proc. Roy. Soc. (London) 201A, 159-74(1950) Mar. 22.

On the assumption that a finite amount of energy is suddenly released in an infinitely concentrated form, the motion and pressure of the surrounding air are calculated. It is found that a spherical shock wave is propagated outward whose radius R is related to the time t since the explosion started by the equation $R = S(\gamma)t^{2/5}E^{1/5}\rho_0^{-1/5}$, where ρ_0 is the atmospheric density, E is the energy released and $S(\gamma)$ a calculated function of γ, the ratio of the specific heats of air. The effect of the explosion is to force most of the air within the shock front into a thin shell just inside that front. As the front expands, the maximum pressure decreases till, at about 10 atm, the analysis ceases to be accurate. At 20 atm 45% of the energy has been degraded into heat which is not available for doing work and is used up in expanding against atmospheric pressure. This leads to the prediction that an atomic bomb would be only half so efficient, as a blast-producer, as a high explosive releasing the same amount of energy. In the ideal problem the maximum pressure is proportional to R^{-3}, and comparison with the measured pressures near high explosives, in the range of radii where the two might be expected to be comparable, shows that these conclusions are borne out by experiment.

4606 The Formation of a Blast Wave by a Very Intense Explosion. II. The Atomic Explosion of 1945. Geoffrey Taylor. Proc. Roy. Soc. (London) 201A, 175-86(1950) Mar. 22.

Photographs by J. E. Mack (MDDC-221) of the first atomic explosion in New Mexico were measured, and the radius, R, of the luminous globe or "ball of fire" which spread out from the center was determined for a large range of values of t, the time measured from the start of the explosion. The relationship predicted in Part I, namely that $R^{5/2}$ would be proportional to t, is surprisingly accurately verified over a range from R = 20 to 185 m. The value of $R^{5/2}t^{-1}$ so found was used in conjunction with the formulae of Part I to estimate the energy E which was generated in the explosion. The amount of this estimate depends on what value is assumed for γ, the ratio of the specific heats of air. Two estimates are given in terms of the number of tons of the chemical explosive T.N.T. which would release the same energy. The first is probably the more accurate and is 16,800 tons. The second, which is 23,700 tons, probably overestimates the energy, but is included to show the amount of error which might be expected if the effect of radiation were neglected and that of high temperature on the specific heat of air were taken into account. Reasons are given for believing that these two effects neutralize one another. After the explosion a hemispherical volume of very hot gas is left behind and Mack's (ibid) photographs were used to measure the velocity of rise of the glowing center of the heated volume. This velocity was found to be 35 m/sec. Until the hot air suffers turbulent mixing with the surrounding cold air it may be expected to rise like a large bubble in water. The radius of the "equivalent bubble" is calculated and found to be 293 m. The vertical velocity of a bubble of this radius is $\frac{2}{3}\sqrt{(g29300)}$ or 35.7 m/sec. The agreement with the measured value, 35 m/sec, is better than the nature of the measurements permits one to expect. (auth)

4607 The Physical Society Reports on Progress in Physics. Vol. 12 (1948-1949). 382p.

The following articles are among those included in this volume: Mass Spectrometry, H. G. Thode and R. B. Shields; Nuclear Paramagnetism, B. V. Rollin; Phosphors and Phosphorescence, G. F. J. Garlick; Recent Nuclear Experiments with High Voltage X-rays, W. Bosley and J. D. Craggs; Linear Accelerators, D. W. Fry and W. Walkinshaw; Viscosity and Related Properties in Glass, G. O. Jones; Theory of Oxidation of Metals, N. Cabrera and N. F. Mott; Fracture and Strength of Solids, E. Orowan; Multipole Radiation in Atomic Spectra, A. Rubinowicz; Collisions between Atoms and Molecules at Ordinary Temperatures, H. S. W. Massey; Low Temperature Physics, K. Mendelssohn; Slow Neutron Absorption Cross Sections of the Elements, M. Ross and J. S. Story.

4608 Relativistic Thomas-Fermi Atom. R. P. Singh. Indian J. Phys. 24, 19-22(1950) Jan.

A relativistic generalization is developed of the Thomas-Fermi equation governing the density of electronic charge inside an atom. The importance of this generalization for the study of the internal condition prevailing in a white-dwarf star is pointed out.

4609 Supernovae. L. B. Borst. Phys. Rev. 78, 807-8 (1950) June 15 (Letter to the editor).

In order to account for the characteristics of supernovae of type I the author proposes the following mechanism. The original star, with a mass many times greater than that of the sun, undergoes gravitational contraction after burning its hydrogen. As the contraction progresses the central temperature will rise until a new reaction occurs. At a temperature of 2 to 3×10^{9}°C a second order endothermic reaction will take place between alpha particles. $2\alpha \rightarrow Be^{7} + n$, Q = −18.6 Mev. This reaction absorbs energy at the center of the star, permitting rapid gravitational collapse. It will proceed until there are sufficient concentrations of the reaction products to produce the reverse reaction. After collapse the star becomes unstable and explodes, driving off a considerable fraction of its mass as an expanding gas cloud, and probably leaving the core in a highly degenerate state.

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4610 Production of Mesons in Proton-Proton Collisions. Vincent Z. Peterson. UCRL-662, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

A target of liquid hydrogen has been bombarded with 345-Mev protons and the mesons produced observed in photographic plates. Exposures have been made in the external beam of the 184-inch cyclotron at 15, 30, and 60 deg to the beam direction. The plates are imbedded in aluminum or copper absorber at an angle so that a complete meson energy spectrum is obtained in a single plate. The energy spectrum at 30 ± 3 deg (based on 116 π-μ decays so far) shows a striking concentration of mesons near the upper energy limit (~50 Mev) with a peak cross section of (8.5 ± 2.0) × 10^{-30} cm^2 Mev^{-1} $steradian^{-1}$. Since the proton energy is near threshold, this appears to indicate a strong interaction between the outgoing nucleons. Present data indicates that a higher energy peak, corresponding to the formation of a real deuteron, may be just within the resolution of the experiment. Only one π^- star has been found, presumably produced in the absorber by elastically scattered protons. Use of a bending magnet with 90-deg focusing for the π^+'s greatly improves the signal-to-noise ratio. Analysis of plates exposed in this manner, with an angular resolution of ±1.5 deg, is now in progress.

4611 Photoproduction of Mesons from Hydrogen. A. S. Bishop, J. Steinberger, and Leslie J. Cook. UCRL-668, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

Using the delayed coincidence technique (Rasetti, Phys. Rev. 60, 198(1941); Steinberger and Bishop, Bull. Am. Phys. Soc. 25, 11(1950)) for detection of artificially produced mesons, we have measured the energy distribution of π^+ mesons from hydrogen. These mesons are formed when the x-ray beam from the 335-Mev electron synchrotron strikes a liquid hydrogen target. Since the photons are completely absorbed in the process of meson creation, there is an exact relationship (for a given angle of emission of mesons) between the energy of the meson and the energy of the photon responsible for its creation. Thus, using the measured energy distribution of the mesons at 90 deg, and the energy distribution of the photons from the synchrotron, we have determined the excitation function for photoproduction of mesons at 90 deg. This function increases rather slowly and flattens off for photon energies above about 280 Mev.

4612 Photo-Mesons from Carbon. J. M. Peterson, R. S. White, and W. S. Gilbert. UCRL-675, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The energy spectrum of negative and positive π-mesons produced in carbon by x-rays from the 330-Mev electron synchrotron in Berkeley has been measured at angles of 45, 90, and 135 deg to the beam axis using C-2 nuclear emulsions. The carbon target was a sphere of 0.620-in. diameter, approximating a point source. The meson detection system employed completely poor geometry; the nuclear plates were imbedded in a massive cylinder of copper surrounding the target. The minus-plus ratio has no statistically significant variation with energy; the average over

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energy appears to be independent of angle and equal to about 1.35 (±0.15 at 90 and 135 deg, ± 0.2 at 45 deg). The energy spectra characteristically have broad maxima in the region from 30 to 70 Mev and fall to zero in the region from 100 to 150 Mev, the exact behavior depending on the angle. More mesons are emitted at 135 and at 90 deg than at 45 deg. The total cross section is about 3×10^{-28} cm^2 per nucleus per quantum.

4613 Positive Mesons Produced by 345-Mev Protons in Liquid Hydrogen. Vincent Z. Peterson. UCRL-678, nd. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The production of mesons in proton-proton collisions has been studied directly using the photographic technique by bombarding a liquid hydrogen target with 345-Mev protons. A "point" source having 0.002 in. Al walls contains the hydrogen, and plates imbedded in copper absorbers are placed at various angles with respect to the beam. Earlier experiments having shown that only positive mesons are produced, a bending magnet has been interposed between target and detector to separate mesons from elastically scattered protons. Exposures made at 30 ± 1.5 deg show an improvement in mesons-to-background of about 100. The sharp peak near the higher end of the meson energy spectrum, indicating a strong interaction between the outgoing nucleons, has been obtained with much better statistics. However the energy resolution was still insufficient to determine whether or not a real deuteron is formed in the process. Further experiments at 15 ± 0.75 deg designed to improve the energy resolution at the upper end of the spectrum, until limited only by the energy spread of the primary beam (~2 Mev), are now in progress and will be reported.

4614 Concerning Meson-Produced Secondary Electrons Emerging from Thin Foils. Frank L. Hereford. J. Franklin Inst. 249, 449-54(1950) June.

The probability is computed that a meson traversing a thin foil will produce at least one secondary electron of sufficient energy to emerge from the foil with the meson. Numerical results are presented for various meson momenta and foil thicknesses, and the bearing of these results upon certain low pressure Geiger-Müller counter experiments is discussed. (auth)

4615 Cosmic Ray "Stars" Due to Atomic Disintegrations Observed with the Photographic Plate. Sara Tamburino. Boll. sedute Accad. Gioenia sci. nat. Catania 4, 92-6(1948-1949).

A study of cosmic ray stars obtained at Catania and on Mt. Etna (6200 ft) gives the maximum number of rays per star at sea level as four and at higher altitude three. A total of 210 stars were observed. Energies were computed for 36 stars, giving results similar to those of Stetter and Wambacher. In some cases, rays from stars gave rise to two or three new rays. These are considered due to nuclear fragments ($Z \geq 2$, $M \geq 3$) emitting protons having energy ≤ 1 Mev and to α particles and smaller nuclear fragments. Instances were found where an initial ray, attributed to a proton, encountered a H atom in the emulsion, ionized it, giving rise to an additional ray. Paths were found having initially rela-

tively little ionization due to a proton of high energy. A path deflection of 4 deg 4 min then occurred giving a dense path indicating lower energy and a high number of ionizations. In other cases, the initial path was more dense than the final one.

4616 Evidence from Cosmic-Ray Bursts for a Nuclear Cascade Process. G. N. Whyte. Phys. Rev. 78, 630(1950) June 1 (Letter to the editor).

The variation of burst rate with atmospheric depth was determined with the use of a number of thin-walled spherical ionization chambers flown to altitudes exceeding 90,000 ft at geomagnetic latitudes 0, 29, and 35 deg N. The flux rate of the burst-producing primaries, deduced from these data, was found to have a maximum at a pressure of approximately 7 cm of Hg. This is consistent with the nuclear cascade picture, according to which each primary particle produces a star, some of the secondaries from which are in turn able to produce further stars, the process continuing until the secondaries have insufficient energies to cause further disintegrations.

4617 γ Decay and Mesons of Spin Zero. C. B. van Wyk. Proc. Phys. Soc. (London) 63 A, 350-7(1950) Apr. 1.

On the assumption that τ mesons are scalar particles and have an appreciable interaction with nucleons, the lifetime of a τ meson at rest decaying into two photons and a pseudoscalar π meson, is calculated by means of standard perturbation theory. The lifetime obtained is $G \times 10^{-12}$ sec where G is the reciprocal of the product of the dimensionless meson-nucleon coupling parameters. This result is roughly what can be expected from observations and, taken together with the results of a previous paper, (Powell et al, Nature 163, 51, 82(1949)), seems to indicate that the heavy mesons have spin zero. (auth)

4618 A Hodoscope Study of Penetrating Cosmic-Ray Showers. I. Local Showers. Kurt Sitte. Phys. Rev. 78, 714-20(1950) June 15.

Showers produced locally in a lead absorber were studied with a hodoscope arrangement. It is shown that, in order to record "local penetrating showers", a rigid selection demanding high penetrating power of the secondaries as well as of the primary must be used. If this is done, some of the discrepancies of recent investigations are removed. For showers capable of penetrating at least 200 g/cm² Pb one finds a collision mean free path of 162 ± 10 g/cm², and for showers of at least 100 g/cm² penetration a mean free path of 196 ± 13 g/cm². In addition, "local soft showers" due to electronic or photonic secondaries of ordinary μ mesons were studied. Their frequency at 3260-m elevation is about 1 in 10^5 traversals of the lead absorber. (auth)

4619 Nuclear Reactions Produced by Slow Negative π Mesons. M. G. K. Menon, H. Muirhead, and O. Rochat. Phil. Mag. 41, 583-618(1950) June.

Reactions produced by the nuclear capture of slow negative π mesons have been studied by the photographic method. Because of the large number of "stars" observed, more than 2500, it has been possible to make a statistical approach to the study of the disintegrations. The general features of the "stars" produced by the disintegration of heavy nuclei

are in satisfactory agreement with the predictions of the evaporation theory. In addition, the emission of fast, singly-charged particles has been observed, most of which must be attributed to an alternative process to that of evaporation. The conclusion is reached that in the initial process of capture, the so-called "primary" process, the energy corresponding to the rest-mass of the π^- mesons is shared among a larger number of nucleons than has commonly been assumed hitherto. Observations on "stars" produced by the disintegration of light nuclei indicate that there is a wide variety in the characteristics of the disintegrations which appear to be strongly dependent on the manner in which the primary distribution of energy takes place. A detailed analysis has been made of some of the disintegrations from C^{12} and N^{14} nuclei, by applying the conservation laws of mass energy and momentum. (auth)

4620 On the Absorption in the Atmosphere of the Cosmic Ray Component Responsible for Stars in Sensitive Emulsions. Michel Jannot and Paule Alleno-Ragougnot. J. phys. radium 11, 102-4(1950) Feb. (in French).

The measurement of the density of stars at two different altitudes has enabled the authors to calculate the range in air of the cosmic ray component producing stars in sensitive emulsions. This range in air has been found to be 154.5 g/cm² (the ranges and altitudes involved are given in terms of the weight of a column of air having the length in question), in good agreement with results already published (George and Janson, Proc. Phys. Soc. 62 A, 243(1949); Perkins, Nature 160, 707(1947)).

4621 On the Method of the Relativistic Cut-off. G. Wataghin. Nuovo cimento 7, 166-7(1950)(Letter to the editor, in Italian).

The method of the relativistic cut-off is applied to the process of the production of mesons during nucleon-nucleon collisions. The cut-off renders improbable the creation of mesons of exceedingly high energies; consequently, in cases when the amount of energy lost during a collision is much higher than the critical energy, the probability of an emission of a single meson is very low, while the creation of several mesons, which is not limited by the operators of the cut-off, assumes a higher probability. The cross section for a nucleon-nucleon collision is practically independent of the energy and is in many cases considerably smaller than the nucleon's geometric cross section.

4622 On the Positive Excess of Mesons. M. Cini and G. Wataghin. Nuovo cimento 7, 135-44(1950)(in Italian).

Assuming the validity of the theory of multiple production of mesons in a nucleon-nucleon collision (Wataghin, Phys. Rev. 56, 1245(1939); Acad. Bras. ciencias, Symposium, 129, (1943); Heisenberg, Z. Physik 101, 533(1936); 126, 573(1949)), calculations are carried out to evaluate the positive excess of μ mesons at sea level. A probability function for the momenta of the created mesons, in the center of mass system ... of two colliding nucleons, is assumed, in accordance with the hypothesis of a relativistic cut-off for transitions involving large exchanges of energy and momenta. The average multiplicity and the mean energy loss of nucleons are

derived, in a relativistically invariant way, from experimental data on absorption and production of energetic nucleons in the atmosphere. The symmetrical theory of nuclear forces, which assumes the existence of neutral mesons, is taken into account. The results of the calculations probably do not hold for energies of μ mesons (at sea level) lower than 1 Bev, while in the range from 1 to 15 Bev the agreement with the recent measurements is satisfactory. (auth)

4623 On the Positive and Negative Excess of the Penetrating Component of Cosmic Radiation at 3500 m above Sea Level. I. F. Quercia, B. Rispoli, and S. Sciuti. Phys. Rev. 78, 824-5(1950) June 15 (Letter to the editor).

With a device similar to that of Bernardini et al (Phys. Rev. 68, 109(1945)) measurements of the "charge effect" were made 3500 m above sea level at 45 deg 50 min north geographical latitude. The "charge effect" is defined as the ratio $[2(N_{cc} - N_{DD})/(N_{cc} + N_{DD})] \times 100$ where N_{cc} and N_{DD} refer, respectively, to the measurements taken with the magnetic lenses converging the positive or negative particles. The authors found that the "charge effect" decreased from positive values in the western direction to negative values in the eastern direction, the observed decrease varying monotonically with the change in zenith angle from west to east.

4624 On the Spectrum of the Generation of Mesons. E. Clementel. Nuovo cimento 7, 109-17(1950)(in Italian).

In the framework of the theory of a "plural" production of mesons through a collision between a nucleon and a heavy nucleus, (Heitler and Janossy, Proc. Roy. Soc. (London) 62 A, 669(1949)), a calculation is made of the spectrum of the generated mesons, by taking into consideration the effect of the secondary nucleons; it is assumed that the cross section for the collision depends on the ratio between the initial energy of the primary and its energy loss. From the spectrum thus obtained, the frequency distribution of penetrating showers is calculated; the agreement with the experiment (Wilson, Nature 158, 415(1946)) is satisfactory. (auth)

4625 On the Spectrum of Mesons Under Dense Materials. P. Budini and G. Poiani. Nuovo cimento 7, 13-20 (1950)(in Italian)

A study is made of the effect of the ionization losses in dense materials on the shape of the energy spectrum of cosmic-ray mesons at sea level. Contrary to the current assumption, the ionization losses are considered as varying with the energy (Halpern et al, Phys. Rev. 73, 477(1948)). It is found that an increasing thickness of the filter produces an increasing flattening of the spectrum curve and a displacement of its maximum toward the low-energy end. (auth)

4626 Positive Excess and Multiplicity in the Production of Mesons. P. Caldirola and A. Loinger. Nuovo cimento 7, 161-5(1950)(Letter to the editor, in Italian).

In a previous paper (Nuovo cimento 6, 565(1949)) the authors have given a theory of the generation of the meson

component of the cosmic radiation, which assumed (1) the existence of a certain energy spectrum of the primary protons at the limit of the atmosphere, and (2) the generation of a single π meson (positive, negative, or neutral) during a collision between two nucleons. This theory is used here for the calculation of the positive excess of the meson component; it is found that only for meson energies <3 Bev the theoretical curve of the excess agrees with the actual one. If the theory is modified so as to assume a generation of two mesons at each nucleon-nucleon collision, the corresponding positive-excess curve is found to lie below that belonging to the first variant of the theory. By combining the two variants, an agreement can be reached up to 10 Bev meson energies. It is concluded that the multiplicity of the meson production depends on the energy of the primary nucleon: while lower-energy nucleons produce single mesons, more energetic ones (up to ~100 Bev) produce two mesons at each collision, etc.

4627 Predominance in the Air of the Penetrating Particles of Showers. Roland Maze. Compt. rend. 230, 742-3(1950) Feb. 20 (in French).

Air showers consist of a mixture of a highly penetrating electronic component with a softer component consisting of mesons and nucleons. It has never been very clear whether the penetrating component is actually present in the air, or is created in the absorbers of the detecting apparatus. If the penetrating component arises in events taking place in the absorbers, the penetrating particles should be emitted more or less isotropically, while the particles of the showers themselves travel nearly vertically. The author used an arrangement of counter telescopes to determine the directional distribution of the penetrating particles and found that their paths are predominantly in the vertical direction. He, therefore, concludes that these particles originate in the air and constitute an essential part of the air shower.

4628 Properties of Particles Emitted During Nuclear Explosions; a Comparison Between Explosions in C and in Pb. A. Lovati, A. Mura, G. Salvini, and G. Tagliaferri. Nuovo cimento 7, 36-47(1950)(in Italian).

The results are given of a series of experiments with a counter-controlled Wilson chamber, which were made at 3500 m altitude. Nuclear explosions in Pb placed above the chamber generated penetrating particles that interacted with the Pb inside the chamber; their mean free path in Pb, for nuclear interactions, was found to be 300 g/cm^2 $\pm 30\%$. The authors' observations are in accordance with the view that a nuclear explosion can generate more than one photon, either directly or by means of an intermediate emission of very short-lived particles. It follows from a comparison between nuclear explosions in Pb and those in C that, in the majority of cases, the incident nucleon interacts with more than one nucleon of the same nucleus. (auth)

4629 Stars of Nuclear Disintegrations in Photographic Emulsions. L. Malaspina, M. Merlin, O. Pierucci, and A. Rostagni. Nuovo cimento 7, 145-53(1950)(in Italian).

Nuclear-evaporation stars were obtained at 4550 m altitude on Ilford C2 plates that were placed under various thick-

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nesses of Pb and Al. Three-prong stars showed a marked transition effect, which was observed also in cases when the plates were placed above the absorbers. Following the theory of Dallaporta et al (Nuovo cimento 7, 99(1950)), this transition effect was attributed to the presence of neutrons, generated through the evaporation of Pb and Al nuclei and projected in all directions. (auth)

4630 Stars and Single Tracks in Nuclear Plates. H. J. Taylor, H. J. Bhabha, R. R. Daniel, J. R. Heeramaneck, M. S. Swami, and G. S. Shrikantia. Proc. Indian Acad. Sci. 31, 130-9(1950) Feb.

Photographic plates exposed at high altitudes show a population of stars and isolated star tracks. Statistics are given covering 288 stars and 655 isolated tracks found in an area of 17 cm^2. Some tracks are closely associated with the stars, and these have a mean range of 4.1 cm air. The remainder, which show no association with stars, have a mean range of 3.4 cm air. Some stars have more than one associated single track. Alternative explanations are discussed. The most probable hypothesis appears to be that the single tracks are produced by the spontaneous disintegration of unstable neutral particles emitted from the stars. (auth)

4631 Transition Effect in the Star-Generating Radiation. N. Dallaporta, M. Merlin, and G. Puppi. Nuovo cimento 7, 99-108(1950)(in Italian).

A small transition effect in the star-generating radiation has been observed by several writers (Bernardini et al, Phys. Rev. 74, 845 and 1878(1948); Cortini, Nature 165, 992 (1949); Freier et al, Phys. Rev. 75, 1451(1949); Malaspina et al, Nuovo cimento 7, 145(1950)). In a phenomenological treatment of the problem, the present authors attribute this transition effect to the presence of secondary neutrons generated in the dense material surrounding the photographic plate. The order of magnitude of the results of the calculation is that of the experimental data. (auth)

4632 Abacs for Noise Calculation in Nuclear Physics Amplifiers. N. F. Moody and M. O. Deighton. National Research Council of Canada Report No. CREL-444, Mar. 3, 1950. 9p.

The "abacs" (graphs) presented here allow rapid calculation of total noise arising at the input stages of amplifiers. Five major contributions to noise are covered, as follows: (1) thermal agitation in pure resistance; (2) shot noise in triodes, with extension of the method to include the partition noise added when the space current divides between electrodes; (3) noise borne by grid current flowing into an integrating circuit; (4) thermal agitation in the resistive component associated with an integrating circuit (i.e., the grid resistor used in conjunction with an ionization chamber, the integration resulting from the capacity of the latter); (5) flicker effect.

4633 An Analog Computer. J. G. Bayly. Rev. Sci. Instruments 21, 228-31(1950) Mar.

An integrator has been constructed which is capable of computing the yield of nuclear reactions produced by radiation of intensity that varies arbitrarily with time. By combining the appropriate number of such machines the yield resulting from a series of consecutive reactions may be found. While the emphasis in this paper is on applications involving the yield of radioactive isotopes produced by a pile or other source of radiation, the instrument may be used to calculate temperatures in thermodynamic problems, voltages and currents in electrical networks, and so on, wherever the quantity (x) to be determined is governed by the differential equation, $dx/dt = -\lambda x + f(t)$, $f(t)$ being a given function of the time, and λ a known constant. (auth)

4634 A Differential Analyzer for the Schroedinger Equation. R. L. Garwin. Rev. Sci. Instruments 21, 411-16(1950) May.

A rapid differential analyzer of accuracy about 0.5% is discussed and its performance reviewed. Extensions to differential equations other than that of Schroedinger are mentioned. (auth)

4635 The Natural Abundances of C^{13} and O^{18}, and the Isotopic Ratios in the Phase Equilibrium of the System Formed by Hydrogen Cyanide and Glacial Acetic Acid. Erwin Willy Becker and W. Vogell. Z. Naturforsch. 5a, 174-5(1950)(in German).

Using CO_2, obtained from HCN by way of CO, the relative isotope abundances of natural C^{13} and O^{18} were determined mass-spectroscopically. The abundance for C^{13} was found to be $1.124 \pm 0.005\%$ and for O^{18} it was $0.2059 \pm 0.003\%$. The above value for C^{13} is determined to one more decimal place than that (1.1%) given in the recent report of Mattauch et al (special issue of the Z. Naturforsch., 1949). In the same set of experiments the C^{13} abundance was determined in CO_2 obtained from HCN that had been enriched in C^{13} by Urey's procedure: in the equilibrium state of the system consisting of HCN(gas) and HCN(solution in glacial CH_3COOH), the C^{13} isotope in HCN of the liquid phase is enriched by about 0.2% with respect to the gaseous phase.

4636 A New Table of Isotopes. Juan J. Schäffer. Bol. facultad ing. Montevideo 3, 355-492(1949)(in Spanish).

This is a comprehensive table covering all the elements through Cm (atomic number 96). Tables and charts of disintegration series are included.

4637 On the Natural Radioactivity of the Atmosphere. Hubert Garrigue. Compt. rend. 230, 1272-4(1950) Mar. 27 (in French).

The author has studied the concentration of radon 219 and 220 in the atmosphere during the period from July 1946 to August 1948 at altitudes ranging from 5000 to 8700 m. At high altitudes (8000 m) air masses rich in radon were found. It appears that, in mountainous regions, radon escapes from fissures in the ground at the base of the mountains when the air is warmer than the ground. The author has also investigated the RaA (Po^{218}) content in the atmosphere.

4638 On the Isotopic Chemistry of Carbonates and a Paleotemperature Scale. J. M. McCrea. J. Chem. Phys. 18, 849-57(1950) June.

The temperature variation of the fractionation of oxygen (O^{16} and O^{18}) in exchange reaction between dissolved carbonate and water and between calcite and water are calculated on theoretical grounds, and checked experimentally. In the course of the experiments it was necessary to investi-

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gate several methods of decomposing calcium carbonate to carbon dioxide for mass spectrometer analysis. A method was developed for growing calcium carbonate from solution with the same isotopic composition as the carbonate shells of organisms produced at the same temperature from water of the same isotopic composition, and the results of these experiments at various temperatures are expressed in an equation relating the temperature of formation with isotopic composition of the calcium carbonate and of the water. (auth)

4639 On the Thermodynamic Degree of Efficiency of Isotope Separation Methods. Gerhard Dickel. Die Naturwissenchaften 37, 164-5(1950)(Brief note, in German).

On the basis of a general thermodynamic theory of irreversible processes, the author has developed the following expression for the efficiency of an isotope separation column

$$\eta = \left[0.2\,\frac{k_T^2}{\gamma(1-\gamma)}\right]\left[\frac{0.1\,s^2}{p}\left(1-e^{-\frac{p}{0.1s^2+1}}\right)^2\right]$$

where $s = wd/D$, $p = vl/D$; w is the mean convection velocity, v the mean velocity of removal of the gas from the column, D the diffusion constant, l the length of the column, d the distance between the cold and hot wall of the column, and k_T the thermal diffusion coefficient. Some experimental material is presented which verifies the formula.

4640 The Separation of the Isomers of In^{114} and In^{112} in an Electric Field. G. J. Goldsmith and E. Bleuler. J. Phys. & Colloid Chem. 54, 717-22(1950) May.

The changes induced in a molecule by the isomeric transition of one of its member nuclei produce ions which can be collected on an electrode placed in a nonconducting solution of the compound. It is shown that the separation of isomers of a metal is possible by subjecting an organic compound of the metal to a high electric field. In the case of the In^{112} isomers, the assignment of half-lives to the two levels has been confirmed unambiguously, that is, the 10-min and 21.5-min periods belong to the ground and excited states, respectively. It is the molecular fragments containing the ground state nuclei which are collected, because of ionization during the isomeric transition, but it is not clearly understood why their charge is negative.

4641 The Use of Dixon Gauge Rings in Isotope Separation Experiments. R. W. McIlroy and G. P. Kitt. Atomic Energy Research Establishment Report No. AERE-C/R-356, May 1949. 17p.

Nine determinations have been made of the enrichment of S^{32} in a 12-in. column with gauze ring packing, by means of the exchange reaction between sulfur dioxide gas and aqueous bisulfite ions. It is concluded that the packing is about one tenth as efficient in this use as in distillation, but compares favorably with Fenske rings. The relationship between flow rate and enrichment is discussed and an estimate made of the size of column necessary to proceed further with this investigation. (auth)

4642 On Discrimination in Mass Spectrometer Ion Sources. G. Careri and G. Nencini. J. Chem. Phys. 18, 897-8(1950) June (Letter to the editor).

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A 60-deg Nier-type mass spectrometer was used to test the ion current vs ion accelerating voltage curve obtained theoretically by Coggeshall (J. Chem. Phys. 12, 19(1944)). Results are reported more fully in G. Careri, et al (Nuovo Cimento 7, 64(1950)) but indicate a stronger discrimination and sharper dependence on the first low accelerating voltage than given by the theory. N_2 and H_2 were used and discrimination increased with their pressure.

4643 A Three-Stage Non-Magnetic Mass Spectrometer. Natl. Bur. Standards (U.S.) Tech. News Bull. 34, 73-5(1950) June.

The velocity selection, r-f mass spectrometer, the technical details of which were reported by Bennett (J. Applied Phys. 21, 2(1950)) and abstracted in NSA as Abstract 4-2728, is illustrated and briefly described. Ions are subjected to an r-f potential at three points along their path. Those having the correct weight arrive at the successive points at the right time and thereby are the only ones to gain sufficient speed to overcome a final retarding potential.

4644 Counting Tubes. Theory and Applications. S. C. Curran and S. D. Craggs. London, Butterworth's Scientific Publications, 1949. 238p.

This book gives a thorough description of the operation, construction, and efficiency of various kinds of radiation counters. The main emphasis is on Geiger-Mueller counters, but ionization chambers, proportional counters, photosensitive counting tubes, photomultipliers, scintillation counters, crystal counters and spark counters are also discussed. Considerable attention is given to the application of these counters in the fields of nuclear physics (measurement of source activities, β- and γ-ray energies, γ-γ and β-β coincidences, etc.), in the field of cosmic radiation (coincidence and anti-coincidence counting, showers, counter-controlled cloud chambers, etc.), as well as in other research involving the use of radiation.

4645 The Efficiency of the G-M Counter. Masateru Sonoda. J. Phys. Soc. (Japan) 5, 53-6(1950) Mar.-Apr.

The γ-ray counting efficiency of a thick Pb-walled G-M counter was computed theoretically for the γ-ray energy range 10 to 34 mc^2. With a 6.5-mm wall of 2 cm inside diameter the efficiency was found to increase linearly with energy over this range. Using a γ-ray energy of 34 mc^2, from the Li-p reaction, the efficiency increased with wall thickness until the latter, at about 5 mm, became roughly equal to the maximum range of secondary electrons. The efficiency then slowly decreased. The efficiency of a thin-walled counter (thin compared with the range of the secondary electrons) was also briefly considered.

4646 An Electron Pair Spectrometer of Lens Type for Hard Gamma-Radiation. Kai Siegbahn and Stig Johansson. Rev. Sci. Instruments 21, 442-5(1950) May.

A new type of pair spectrometer is described. The rotation of the image in a short magnetic lens is used to separate negatrons and positrons by putting the pair converter a little aside from the optical axis of the lens. It is then possible to obtain coincidence "lines." The apparatus has been tried

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on the 2.62-Mev γ ray of ThC'' (Tl^{208}) and the 2.76-Mev γ ray of Na^{24}. (auth)

4647 Herschel Effect on the Latent Tracks of α Particles. H. Sauvenier and L. Winand. Science et inds. phot. 21, 18(1950) Jan. (in French).

Ilford C2 plates and experimental plates containing pure silver bromide were exposed to the radiation of Po in such a manner as to obtain a spot of density lying in the linear region of the density curve, and several isolated tracks in addition. After this exposure, the image of an incandescent tungsten filament was projected onto the latent tracks through an infrared filter (Wratten No. 87). A marked Herschel effect was noted, both in the case of the spot and in the case of the isolated tracks. The tracks appeared faded after development, and the amount of fading increased with the infrared intensity. Pre-exposure to infrared did not effect the sensitivity of the plates to α particles.

4648 Magnetic Spectrometer of Large Solid Angle. E. R. Rae. Phil. Mag. 41, 525-33(1950) June.

An account is given of a magnetic spectrometer of large solid angle and good resolution which should find applications in the study of complex β-ray spectra by the method of β-γ coincidences. The original apparatus, consisting of a segmented annular Geiger-Mueller counter set round a radioactive source in a magnetic field is described, the method of use being to select from the output of the counter, large pulses which correspond to the simultaneous triggering of several sections by the passage of an electron tangentially to the annular counter. The performance of the instrument is discussed and modifications are described which rectify the defects in the earlier design and give a solid angle of 2.5% of 4π with a resolution of 5%. The geometry of this type of spectrometer is considered and the performance which might be obtained with good design is discussed. It is concluded that collecting angles up to the order of 50% of 4π are possible with good resolution. (auth)

4649 On the Determination of the Trajectories of Low Energy Alpha Particles in Nuclear Emulsions. Pierre Cüer, Jean-Pierre Lonchamp, Jean Combes, and Serge Gorodetzky. Compt. Rend. 230, 1764-6(1950) May 15 (in French).

The author shows that fine grain Ilford D_2 emulsions may be used for the accurate determination of the range of low energy alpha particles, and discusses the refinements in statistical methods which are required to attain high accuracy.

4650 On the Possibility of Eliminating Parasitic Electrons Recorded in a Nuclear Emulsion without Destroying Its Sensitivity. Georgette Albouy. Compt. rend. 230, 1351-3(1950) Apr. 3 (in French).

By exposing Ilford G5 emulsions to the action of saturated water vapor at a temperature of 50°C for a period of about 75 hr, it is possible to eradicate the latent images of electron tracks without destroying the sensitivity of the emulsion. This method may be used to eliminate background electron tracks in plates before using them in experiments. By "parasitic electrons" the author means electrons produced in the plates by background activity to which the plate is exposed before its use.

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4651 On the Stopping Power of Nuclear Emulsions for Charged Particles of Low Energy. Pierre Cüer, Jean-Pierre Longchamp, Jean Combes, and Serge Gorodetzky. Compt. rend. 230, 832-4(1950) Feb. 27 (in French).

The authors have made a systematic study of the range-energy relation for low energy charged particles in emulsions, with the aid of reactions of known energy. Results are given for the point on the range-energy curve corresponding to protens with a 2 cm range in air. The data was obtained from triton tracks originating in the reaction $Li^6(n,H^3)He^4$. The triton ranges were measured in Ilford D plates loaded with lithium, and the neutrons were obtained by bombarding beryllium with protons. The average triton range was found to be 35.46 ± 0.2 μ.

4652 Particle Identification in Photographic Emulsions by the Delta-Ray Method. L. Voyvodic. Can. J. Research 28, 315-23(1950) May.

δ rays are defined as "knock-on" electrons producing short spurs accompanying the tracks of energetic heavy particles. A comparison is made in this study between their densities expected theoretically and those observed experimentally on charged particle tracks in Ilford G5 emulsions. The energies of δ rays are determined here by means of grain-counting measurements and energy-loss considerations. Using this method of energy determination and the theoretical formula for δ-ray density, good agreement has been found with the experimental distributions on proton, μ-meson, deuteron, and α-particle tracks. The agreement is satisfactory both in absolute value and in the shape of the δ-ray density distribution. These results are considered to show that the δ-ray technique is suitable as an absolute method of charged particle identification in photographic emulsions. (auth)

4653 Rapid, Fine Grain Emulsions and The Recording of Electron Tracks. R. W. Berriman. Science et inds. phot. 21, 29-30(1950) Jan. (in French).

The author describes the mechanics of formation of latent images by particles in fast emulsions, discussing the relation between the speed of the emulsion and the size of the grain. He then applies these considerations in a study of Kodak NT-2a emulsions and concludes that these emulsions are fast enough to record the tracks of electrons with energies up to about 80 kev. The emulsion sensitivity must be tripled if it is to record the tracks of electrons at minimum ionizations.

4654 A Simple Counter Tube Amplifier. H. Goldstein. Z. angew. phys. 1, 329-30(1949) Mar. (in German).

Simple two and three hard-valve circuits for amplifying and counting Geiger counter impulses are briefly described. The circuits, given in detail, are suitable for use with two and 50 MΩ counter tube resistances for the two and three valve circuits, respectively.

4655 Theory of the Beta Spectrograph with Short Coil. Pierre Grivet. Compt. rend. 230, 936-7(1950) Mar. 6 (in French).

Two articles have appeared recently on the theory of the β spectrograph with focal isolation (Paquien and Grivet, Compt. rend. 230, 64(1950); 196(1950)). The author has applied

this theory to the special case in which the field is produced by a short coil. In calculating the distribution of field in the spectrometer, the thickness of the coil is neglected. Various characteristics of the spectrometer, such as the focal distance, the dispersion and resolving power, are tabulated for different values of the coil cross section and of the other instrument parameters, and these operating characteristics are compared with the characteristics of the Siegbahn type of spectrometer.

4656 Use of Vycor Glass for Scintillation Counting. C. P. Glover and H. Friedman. Naval Research Laboratory, Jan. 9, 1950. 4p. (AEC File No. NP-1370.)

The report points out that Vycor glass, because of its low atomic number components, fulfills spectral sensitivity requirements more adequately than most of the phosphors now being considered for scintillation counting; that it has several other desirable characteristics, i.e., production and physical characteristics, internal incorporation in the multiplier tube, and reasonable stability over a wide temperature range; and that its efficiency for conversion of γ-ray energy to blue fluorescent light is high enough (about 10 to 13 times less efficient than anthracene) to merit consideration along with other phosphors.

4657 Quarterly Report. Columbia Radiation Laboratory. Mar. 31, 1950. 34p. (AEC File No. NP-1498.)

Research projects are briefly reported for January through March 1950. I. The generation of high frequencies: 38 vane magnetrons at 4.5 mm; 38 vane magnetrons at 3 mm; magnetrons for harmonic generation; enhanced emission from magnetron cathodes; magnetron space charge experiment. II. Microwave apparatus and techniques: improvements in hot test equipment; metering system for hot test calorimeter; mechanical spectrum analyzer; R-F envelope viewer; standing wave machines and tuners; millimeter crystals; copper electroforming; external cavities for long wavelength klystrons. III. Tube fabrication techniques: hob grinding and hot hobbing. IV. Microwave physics: fine structure of the hydrogen atom; ionized helium fine structure; electron polarization experiment; absorption measurements in gases; resonant modulation; vacuum technique-valves; the numerical calculation of the electromagnetic energy level shift; microwave spectra of free radicals; effect of Fermi resonance on rotation-vibration interaction in OCSe and ICN; nuclear masses and the "magic number" 20.

4658 The Borides of Some Transition Elements. Roland Kiessling. Acta Chem. Scand. 4, 209-27(1950).

A comprehensive discussion of the structural work on the borides of the transition elements is given, including tables of axial lengths and interatomic distances. The structures are discussed with respect to the arrangement of the boron atoms. The boron atoms appear isolated, in chains, in double chains, in nets or in three-dimensional boron frameworks; the crystallographic evidence clearly shows that the boron-boron contacts are of bonding character. Similarities between borides and hydrides, carbides, and nitrides exist, but Hägg's critical radius ratio is valid only if the boron atoms appear isolated in the metal lattices. Pauling's theory for the metallic state seems not to be applicable to the borides. For the borides with chains, for instance, according to Pauling an electron transfer from the metal to the

boron chains occurs. The author thinks, according to the experimental evidence, that an electron transfer in the opposite direction is more probable.

4659 Variation of High Energy Neutron Collision Cross Sections with Energy. J. DeJuren and B. J. Moyer. UCRL-681, Apr. 28, 1950. 1p.

The document is in abstract form; it is reproduced below in its entirety.

An investigation of the variation of nuclear total cross sections for neutrons between 90 and 270 Mev has been made using bismuth fission for detection. The bombardment of a 0.5-in. Be target with protons in the 184-in. cyclotron produces a neutron flux of mean energy approximately 70 Mev less than the incident proton energy for bombarding energies between 160 and 350 Mev. The total cross sections of carbon, aluminum, copper, and lead approach constant values in the neutron energy interval between 180 and 270 Mev. The total hydrogen cross section decreases less rapidly than $1/E$. At 95, 160, 220, and 270 Mev its values are respectively 73 ± 1.5, 51 ± 2.6, 41 ± 2.4, and 38 ± 1.5 millibarns.

4660 Angular Distribution of Neutrons at the Interface of Two Adjoining Media. B. Davison. Can. J. Research 28, 303-14(1950) May.

Two media separated by a plane interface and each filling an infinite half-space are considered. Neutrons come in infinite number from infinity in one medium and the neutron density vanishes at infinity in the other medium. Isotropic scattering in the laboratory system of co-ordinates in both media is assumed and all neutrons are assumed to have the same speed. The angular distribution of neutrons emerging from either medium into the other is obtained in terms of the angular distribution of neutrons emerging from a scattering medium into a vacuum. The latter angular distribution is tabulated in a preceding paper (Neutron Density Near a Plane Surface in a Capturing Medium. Can. J. Research 28, 242(1950)) by LeCaine. (auth)

4661 Calculations of Functions Used for Determining Neutron Diffusion at Large Distances from the Source by Bethe's Method. J. P. Price. Atomic Energy Research Establishment Report No. AERE-T/R-523, Apr. 1950. 16p.

This report discusses the numerical calculation of the functions given by Bethe (AECD-2105) for determining neutron diffusion at large distances from the source, and makes possible their use in practical problems. (auth)

4662 The Neutron Density Near a Plane Surface in a Capturing Medium. Jeanne LeCaine. Can. J. Research 28, 242-67(1950) May.

The variational method is applied to the Milne problem with capture, to obtain, for the density and angular distribution of neutrons near a plane surface in a capturing medium, expressions which give accurate values and which have a relatively simple analytical form. Tables of the density and angular distribution are included. The extrapolation distances determined by the Variational Method agree to high accuracy with the exact values. The angular distribution determined by the Variational Method is shown to be accurate within 0.05% in all cases where exact results are available. Tables are also given for the density and angular distribu-

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tion in the Milne problems with capture and constant production. (auth)

4663 On the Scattering of Polarized Neutrons by Protons. A. B. Bhatia. Proc. Phys. Soc. (London) 63 A, 502-14(1950) May 1.

A similar article by the author was published in Nature 164, 662(1949) Oct. 15 (Letter to the editor). An abstract of this letter appeared in Nuclear Science Abstracts as Abstract 4-250.

4664 Scattering of 90-Mev Neutrons by Alpha Particles. Discussion. Jean Heidmann. Compt. rend. 230, 831-2(1950) Feb. 27 (in French). (See also NSA 4-3505.)

The author compares the results of theoretical calculations previously reported (Compt. rend. 230, 724(1950)) with the experimental features of the scattering of 90-Mev neutrons by α particles. Since no data on this process is directly available, the author uses data on scattering by C^{12} and O^{16}, assuming an α particle model for these nuclei in order to relate these results with the theory. The calculated total scattering cross section is 20% too low. This discrepancy is attributed to the use of the Born approximation. The cross section for the production of fast deuterons is much too large, but the angular distribution of the deuterons is in good agreement with experiment. The inelastic scattering cross section alone also agrees well with the experimental value.

4665 Scattering of 90-Mev Neutrons by Alpha Particles. J. Heidmann. Phil. Mag. 41, 444-57(1950) May.

A similar article by the author was published in Compt. rend. 230, 724(1950) Feb. 20. An abstract of this article appeared in Nuclear Science Abstracts as Abstract 4-3505.

4666 An Experimental Investigation of the Nuclear Magnetic Moments of D^2 and H^1. Gunnar Lindström. Phys. Rev. 78, 817(1950) June 15 (Letter to the editor).

The magnetic moment of D^2 in D_2O was measured against the magnetic moment of H^1 in two different chemical compounds (H_2O and paraffin oil) according to the resonance absorption method. According to these measurements there seems to be a small effect depending on the different chemical compounds. The results were:

$\mu_D/\mu_H = 0.30701337 \pm 0.00000050$ for D_2O and H_2O

$\mu_D/\mu_H = 0.30701465 \pm 0.00000050$ for D_2O and paraffin oil.

4667 Hyperfine Structure of $4^{1,3}F-nG$ of the Spectrum of Al II. S. Suwa. Phys. Rev. 78, 810-11(1950) June 15 (Letter to the editor).

The $4^{1,3}F-nG$ series of Al II was taken as an extreme example of anomalous hyperfine structure which appears when the mutual distances of terms of a multiplet are comparable with the hyperfine splitting due to nuclear spin. The observed spectrum is illustrated along with a theoretical one, the derivation of the latter being based on certain named assumptions but not shown.

4668 The Measurement of Nuclear Magnetic Moments. J. von Harlem. Elektron. 3, 226-31(1949) June (in German).

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After a theoretical discussion of the nuclear magnetic moments, the author describes the nuclear resonance methods of measuring these moments with the aid of crossed magnetic fields. One of these fields is a strong, steady field, while the other is a weaker oscillating field. The magnetic moment may be determined either by varying the intensity of the fixed field, or by varying the frequency of the oscillating field until a resonance point is detected. At this resonance, energy is drawn from the oscillating field, and the electronic characteristics of the circuit producing the field undergo detectable changes.

4669 Nuclear Coupling and Shell Model. Giulio Racah. Phys. Rev. 78, 622-3(1950) June 1 (Letter to the editor).

In a recent paper (Feenberg, Phys. Rev. 76, 1275(1949)) some general aspects of nuclear structure were examined from the point of view of strong spin-orbit coupling. It was considered as a reasonable supposition that the statistical weight of the singlet component for states in the antisymmetric j^2 function space attains a maximum for spin $I = 0$. With the aid of Dirac's vector model, the author proves this assumption and extends the calculation to the antisymmetrical j^n function space, i.e., to n-like particles in equivalent orbits.

4670 Nuclear Magnetic Moment of Sc^{45}. D. M. Hunten. Phys. Rev. 78, 806(1950) June 15 (Letter to the editor).

Resonance in Sc^{45} was observed in a saturated acid solution of $ScCl_3$. The ratio of the resonant frequency to that for protons was found to be 0.242939 ± 0.000003. Using the value 5.58494 ± 0.00016 of Hipple, et al (Phys. Rev. 76, 1877(1949)) for the gyromagnetic ratio of the proton, and including a diamagnetic correction of 0.151%, the gyromagnetic ratio of Sc^{45} was determined as 1.35885 ± 0.00005. With a spin $7/2$, Sc^{45} therefore has a magnetic moment of 4.7560 ± 0.0002 nuclear magnetons. This value is in good agreement with the spectroscopic result of 4.8 nuclear magnetons, obtained by Kopfermann and Wittke (Z. Physik 105, 16(1937)).

4671 On the Possibility of a Complex Structure for Particles of Spin 1. Louis de Broglie and Marie-Antoinette Tonnelat. Compt. rend. 230, 1329-32 (1950) Apr. 3 (in French).

The authors examine the hypothesis that particles of spin 1 may be considered as composed of two particles of spin ½. The equations obtained permit the satisfactory description of a pseudoscalar state and a vector state. The results for the pseudoscalar state are in good agreement with those published by Fermi and Young (Phys. Rev. 76, 1739(1949)). This work is a repetition of work previously carried out by de Broglie (Compt. rend. 203, 473(1936)), with the following corrections: an interaction term of the form proposed by Fermi was included in the wave equation, and the mass of the composite particle was not assumed to be equal to the sum of the masses of the components since the stability of the particle requires a mass defect.

4672 On the Possibility of Electric Dipole Moments for Elementary Particles and Nuclei. E. M. Purcell and N. F. Ramsey. Phys. Rev. 78, 807(1950) June 15 (Letter to the editor).

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It is generally assumed on the basis of some suggestive theoretical symmetry arguments that nuclei and elementary particles can have no electric dipole moments. It is the purpose of this note to point out that although these theoretical arguments are valid when applied to molecular and atomic moments whose electromagnetic origin is well understood, their extension to nuclei and elementary particles rests on assumptions not yet tested. The question is, in the view of the authors, purely experimental. The evidence from most past experiments on molecules, atoms, nucleons, and elementary particles is not conclusive enough. The authors announce that they are undertaking an experiment to measure directly the electric dipole moment of the neutron with a neutron beam magnetic resonance apparatus of high resolution to detect a possible shift of the neutron precession frequency upon the application of a strong electric field.

4673 On the Theory of Particles with a Higher Spin. E. S. Fradkin. Zhur. Eksptl. i Teoret. Fiz. 20, 27-38(1950)(in Russian).

Equations are derived for particles with an arbitrarily-high half-integral spin; (for integral spins the problem has been solved by Fierz and Pauli, Proc. Roy. Soc. (London) 173 A, 211(1939)). It is shown that, under certain conditions, the equations found are not unique. The reduction of the equations for particles in excited spin states is discussed.

4674 Search for Nuclear Energy Levels in C^{13}. D. W. Miller. Phys. Rev. 78, 806(1950) June 15 (Letter to the editor).

The total cross section of carbon for fast neutrons was determined for neutron energies between 20 and 1360 kev. By means of a transmission experiment of the type previously described (Phys. Rev. 76, 1146(1949)), the cross section was measured with neutrons produced by the Li^7 (p,n)Be^7 reaction. A smooth monotonic decrease in the total cross section from 4.8 barns at 20 kev to 2.4 barns at 1360 kev neutron energy was obtained. If resonances are to be observed corresponding to possible levels in C^{13} listed by Hornyak and Lauritsen (Rev. Mod. Phys. 20, 209(1948)) at 5.0 and 6.0 Mev excitation energies, they should appear at neutron energies of 130 kev and 1210 kev. On the basis of the Breit-Wigner resonance theory, the variation in cross section for such resonances should be at least 24 barns and 2.5 barns, respectively. No such resonances were observed. On the basis of the resolution used, it may be estimated that the natural width of such levels, if they exist, is less than 5 kev.

4675 Selection Rules Relating to Forbidden Beta Transitions. II. Roger Nataf. Compt. rend. 230, 737-9 (1950) Feb. 20 (in French). (See also NSA 4-3513.)

In a previous article (Compt. rend. 230, 532(1950)) the author described a simple classification of forbidden β transitions according to the change of nuclear orbital angular momentum. A table of transition probabilities appearing in this previous article is reproduced. The previous paper treats the change in the total angular momentum, ΔJ, involved in these transitions.

4676 The Uranium Pile (2). Terence Price. Atomics 1, 167-170, 177(1950) June. (See also NSA 4-4071.)

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In continuation of a previous discussion (Atomics 1, 99-106 (1950)), the author deals with the choice of coolants for uranium piles, the health hazards to the personnel operating a pile, and the design of protective shields. The by-products of uranium piles are described, and the working life-time of a pile is assessed. 20 references.

4677 Chemical Change through Neutron Capture (Szilard-Chalmers Effect). Engelbert Broda. Osterr. Chem.-Ztg. 51, 32-5(1950).

This is a complete review of chemical effects and changes induced by the Szilard-Chalmers effect. 43 references.

4678 Chemical Kinetics of Bromine Following Neutron Capture. Russell R. Williams, Jr., and William H. Hamill. J. Chem. Phys. 18, 783-8(1950) June.

This article is an amplified version of a letter to the editor which appeared in J. Chem. Phys. 16, 1171(1948) Dec. An abstract of this letter was published in Nuclear Science Abstracts as Abstract 2-432.

4679 The Chromium Isotope of Mass 55. Daniel R. Miller. Phys. Rev. 78, 808(1950) June 15 (Letter to the editor).

MnO_2 was irradiated for 2.7 hr with neutrons of maximum energy 16 Mev. It was then dissolved in a nitric acid-hydrogen peroxide mixture, inactive Cr^{+3} was added as carrier, and the chromium fraction was chemically separated and purified. The activity observed 2.5 hr after the end of the bombardment was not appreciably different from the background rate. The only unstable chromium isotope which could have resulted from the irradiation is Cr^{55}, produced by a (n,p) reaction on Mn^{55}. The results of this investigation indicate that, if Cr^{55} has a half-life in the previously reported range (1.3 to 2.3 hr), the cross section for its formation by Mn^{55}(n,p)Cr^{55} is less than 5×10^{-5} barn.

4680 Fast Neutron Bombardment Effects in Germanium. J. H. Crawford, Jr., and K. Lark-Horovitz. Phys. Rev. 78, 815(1950) June 15 (Letter to the editor).

Germanium was bombarded with neutrons in a nuclear reactor. A study was made of the conductivity of the bombarded germanium as a function of the amount of neutron irradiation. The bearing of this relation on the theory of semiconductors is discussed.

4681 On Neutron Deficient Isotopes of Barium. Charles C. Thomas, Jr., and Edwin O. Wiig. J. Am. Chem. Soc. 72, 2818(1950) June. (Communication to the editor).

Bombardment of cesium with 250-Mev protons produced two previously unreported positron emitting isotopes of barium. These are Ba^{129} with a half-life of 1.8 ± 0.2 hr and a hard β^+ of undetermined energy and $Ba^{<129}$ with a half-life of 2.4 ± 0.1 days with a β^+ energy of 3.1 ± 0.3 Mev.

4682 Transmutation-Produced Germanium Semiconductors. J. W. Cleland, K. Lark-Horovitz, and J. C. Pigg. Phys. Rev. 78, 814(1950) June 15 (Letter to the editor).

Germanium was activated by exposure to irradiation in a nuclear reactor. On the basis of capture cross sections ob-

tained for the isotopes with mass numbers 70, 72, 73, 74, and 76, the authors reach the conclusions that in germanium semiconductors there is a balance between donators and acceptors, that the Hall effect and conductivity are determined by the excess type present, that there is one current carrier produced per impurity center produced, and that the activation energies of impurity centers produced chemically and by transmutations are in agreement, which indicates that chemical doping is a substitution process.

4683 Operation of the Berkeley Synchrotron. Marvin Martin. UCRL-648, Mar. 29, 1950. 1p.

The document is in abstract form; it is reproduced below in its entirety.

The Berkeley Synchrotron has been operating since December 1948, accelerating electrons to 335 Mev and producing x-rays of 335-Mev peak energy from these electrons hitting a target. Design and operating parameters of the synchrotron are presented. Measurements are described which proved necessary to get the machine into operation and to increase the output to its present value.

Electrons are injected into the orbit from a conventional electron gun at 100 kv. Acceleration to 2 Mev is accomplished as a betatron. The radiofrequency accelerating voltage is then turned on and synchronous acceleration continues till the particles reach an energy of 335 Mev.

The most critical adjustments proved to be those pertaining to the magnetic field shape and rate of change during the betatron phase of acceleration.

4684 The Design of the Bevatron Magnet. D. Sewell. UCRL-682, Apr. 27, 1950. 2p.

The document is in abstract form; it is reproduced below in its entirety.

The magnet for the Bevatron (proton synchrotron) that is being constructed at the University of California at Berkeley has been designed from the experience which was gained from tests on one-twelfth scale d-c and pulsed model magnets and from the operation of a quarter scale model of the entire machine.

The magnet will be built in the form of a ring that is divided into four quadrants which are spaced 20 ft from one another at the ends. The ring will have a rectangular cross section 10 ft high by 21 ft wide. The quadrants will be built on a 48½-ft radius to the centerline of the gap which means the over-all distance across the magnet will be about 135 ft.

Ninety seven hundred tons of ½-in. and ¼-in. thick mild steel plate are required for the magnet. These plates a are being bolted together in 2.5-deg sections; the sections will then be assembled to form the entire magnet. The plates outside the vacuum tank are being insulated from one another with 0.020-in. thick cardboard; those inside will be insulated with baked enamel.

The exciting coils will be wound with 137,500 ft of 1,678,000 circular mil copper cable insulated with varnished caimbric. Each quadrant of the magnet will have individual exciting windings which will be connected externally to form the desired circuit. The coils will be held in place by molded bakelite spacers and clamps which will give the desired spacing so that cooling air can be circulated around each wire. Cooling air will be fed from two 250-hp blowers to the magnet through ducts in the floor at the rate of 560,000 cu ft/min.

The air gap in the magnet through which the protons travel while they are being accelerated will be 2 ft high by 8 ft wide. This region will be enclosed by a stainless steel tank that is an integral part of the magnet structure and the whole region will be evacuated to a pressure of the order of 10^{-6} mm Hg.

The magnet will be pulsed 10 times per minute with the current rising from 0 to 8333 amp in 1¾ sec. The magnetic field in the air gap will rise at an initial rate of 6600 gauss/sec; this rate will fall gradually to 4000 gauss/sec at the peak current. The peak field in the air gap will be 9800 gauss.

The inductance of the magnet will vary from 4.15 h at 200 amp exciting current to 1.3 h at 8333 amp. The total resistance of the exciting coils will be 0.267 ohms at 65°C. The peak required kilovolt amperes will be 100,000 kva while the time average power dissipation will be about 3500 kw, of which 230 kw will be dissipated by eddy current and hysteresis losses in the steel. The peak stored energy in the magnet field will be about 80,000 kw-sec.

The initial excitation voltage will be 18 kv and this will drop to 12 kv at peak current at which time the I.R. drop will be about 2200 volts.

The 2½-deg stacks of steel plates for the magnet are being assembled at the present time. Plans call for the steel erection to start late this summer.

4685 Frequency Control for the Bevatron R-F Voltage. Jack Riedel. UCRL-692, May 4, 1950. 2p.

The document is in abstract form; it is reproduced below in its entirety.

The radio-frequency voltage used to accelerate the proton beam in the bevatron is initially derived from an LC oscillator operating at low level. The frequency of this oscillator must cover the range from 350 to 2500 kc as the magnetizing current goes through the range from 200 to 8300 amp. During this time the frequency versus current relationship required to accelerate the proton beam must be accurately maintained to within 0.05 per cent.

The variable element in the control oscillator is a saturable inductance, consisting of toroidal coils wound on Ferroxcube III, a ferromagnetic ceramic. This material has relatively high Q's at r-f frequencies and is capable of being easily saturated through a permeability range of 800 to 1. The saturation in this case is accomplished by diverting a portion (5 per cent) of the bevatron's magnetizing current through a one turn winding around the toroids. The fixed circuit parameters of the oscillator are adjusted in such a way as to cause the frequency to track the saturating current in the required manner. Long time stability is achieved by temperature regulating the various temperature-sensitive circuit elements.

The output of the low level control oscillator is fed to a self-tuning amplifier circuit. This self-tuning is accomplished by using a Ferroxcube III saturable inductance in the resonant output circuit and continuously adjusting the saturating current through it by means of an automatic phase detecting feed-back circuit.

The output of this amplifier is used to drive the final power amplifier, which incorporates this same self-tuning

feature in its output circuit. The output voltage from this final amplifier is applied to the beam accelerating electrode, which consists of a hollow rectangular cylinder 11 ft long with a cross section of 2 by 5 ft. The beam in passing through this cylinder is accelerated by a potential difference of approximately 1100 volts out of a total of 20,000 peak to peak volts applied to the electrode.

This general method of frequency control is the same as that used on the quarter-scale model bevatron which operated successfully during the summer of 1949.

4686 Pulsed Power Particle Accelerators. George M. Farly. UCRL-693, May 4, 1950. 2p.

The document is in abstract form; it is reproduced below in its entirety.

Modulated or pulsed accelerators are used where it is necessary to compensate for a significant change in mass during the acceleration of a charged particle. Several forms of these machines at the University of California depend upon a magnetic field for controlling and timing the succession of energy gains given to the charged particles. Two machines are heavy particle accelerators and one is a light particle accelerator.

Each one of these machines is used to increase the velocity of a charged particle and thus add to its kinetic energy. The machines differ principally with respect to the range of velocities and frequencies which occur during the acceleration. In the more or less familiar cyclotron, particles start from rest and circulate at relatively constant frequency. The particles travel in paths of increasing radius as they gain energy. When the frequency of the machine is adjusted during the acceleration, the particles can be accelerated to higher energy than when a fixed frequency is employed. There is one burst of ions which sweeps through the machine during each swing in frequency. Energies of around 350 Mev are obtained in the University of California synchro-cyclotron.

To obtain very high energies by the same means calls for a much larger machine. Since the cyclotron weighs around 4000 tons, a proportional expansion in linear dimensions is not practical. Fortunately, such a plan is avoided by a change in design. The general scheme is to use a racetrack type of construction with the magnetic structure concentrated at large radius. Then in order to control particles through a range in energy, a variable magnetic field must be established. In this case, a pulse of ions is accelerated each time the magnetic field is increased. It is also necessary to track the radio frequency in such a way as to obtain synchronous acceleration at constant radius. At any one value of field there is one velocity of particle which will be deflected at precisely the correct radius to stay in the accelerating chamber. The correct synchronizing frequency is equal to that particular velocity divided by the distance around the accelerating chamber.

Particles are not started from rest in this type of accelerator. Rather, they are injected after a preliminary acceleration in another system. This injection must occur when the magnetic field is appropriate to the energy of the injected particles.

The magnetic pole shapes must be such as to provide a stable groove within the accelerating chamber so that particles do not oscillate away from the central orbit. The frequency control must be correct so that the particles can

gain energy at the correct rate to stay in the accelerating groove. These magnetic and radio-frequency features are described in separate papers.

Due to the energy stored in the magnetic field of the bevatron, it takes two seconds to build up the field. This requires a special power supply consisting of two large flywheel motor generator sets. The energy flow is controlled by the conduction of large mercury vapor rectifiers. Energy storage in flywheels is more economical than storage in capacitors when the rate of release of energy is low. For example, the very large synchrotron capacitor bank will store around 125,000 wsec. whereas the total energy in the bevatron flywheels will exceed 650,000,000 wsec.

4687 R. F. Power Supply for a 500-kv Ion Source. John R. Woodyard. UCRL-694, May 5, 1950. 2p.

The document is in abstract form; it is reproduced below in its entirety.

A half-million-volt d-c power supply is required for accelerating the proton beam before injection into a linear accelerator where it is further accelerated to 10 million volts prior to injection into the Berkeley bevatron.

Because of the linear accelerator the voltage stability requirements are rather severe. The voltage must be held constant to within 500 volts out of 500 thousand while delivering currents of several milliamperes. In order to keep the power supply within reasonable dimensions, it was decided to use a cascade rectifier with r-f input. Although the choice of frequency is not critical, the optimum is in the vicinity of 100 kc. Much lower frequencies cause the apparatus to become bulky and frequencies above half a megacycle cause the stray-capacity currents to become intolerable.

The circuit is that used by Cockroft and Walton in 1930 at power frequencies. Twenty-six stages are used in cascade. The required voltage stability is obtained by an electronic voltage regulator in the ground lead.

For convenience it was desired to work at atmospheric pressure and to keep the longest dimension of the power supply to 6 ft. Because of space limitations and the low dielectric strength of air at atmospheric pressure the rectifier itself is oil filled. For ease in servicing, the 26 stages are broken up into 13 units, so that any unit can be quickly replaced by a spare in case of breakdown.

Each unit consists of two type 8013A rectifier tubes, two 0.016 mfd 40 kv condensers, and one filament transformer all contained in a cylindrical lucite case approximately 12 in. in diameter and 6 in. long, which is filled with transformer oil. The oil is circulated for cooling purposes through a heat exchanger at ground potential via a lucite plumbing system.

In order to heat the rectifier tube filaments which are at high voltage above ground, a cascade connection of r-f isolation transformers is used. These transformers use torodal cores made of a newly-developed ferrite which is a homogeneous ferromagnetic insulator.

The rectifier has performed very reliably at 500 kv. It has been in operation for one month without a high-voltage breakdown.

4688 Detection of Magnetic Resonance by Ion Resonance Absorption. H. Sommer and H. A. Thomas. Phys. Rev. 78, 806(1950) June 15 (Letter to the editor).

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By combining the techniques of nuclear resonance absorption and the omegatron (Hipple et al. Phys. Rev. 76, 1877 (1949)), the cyclotron resonance of H_2^+ ions has been observed dynamically with an oscillating detector coupled directly to an oscilloscope. If a r-f voltage satisfying the cyclotron relationship $\omega = eH/Mc$ is applied to two parallel plates between which ions are produced and trapped as in the omegatron, the ions will absorb energy from the r-f field. If these parallel plates are made part of the capacitance of a parallel resonant circuit, the energy absorbed by the ions can be detected in exactly the same manner as nuclear resonance absorption. Whereas nuclear resonance absorption is detected by the power absorbed in the inductance, the cyclotron resonance here described produces a power loss in the capacitance. (auth)

4689 On the Possibility of Accelerating Electrified Particles Rectilinearly without Energy Limit. Max Hoyaux. Acad. roy. Belg., Classe sci., Mem. 36, 148-53(1950)(in French).

Radiation loss in linear accelerators is much less serious than radiation from particles traveling in curved trajectories. For this reason it is theoretically possible to accelerate particles to any desired energy in linear accelerators. However, it is necessary to overcome certain difficulties, primarily connected with phase stability and stability with respect to radial oscillations, before the full potentialities of linear oscillators may be realized. The author sets up the equations of motion for particles in linear accelerators operating in certain specific modes, and describes the conditions required for phase stability and radial stability.

4690 Angular Correlation of Successive Gamma-Rays. E. L. Brady and M. Deutsch. Phys. Rev. 78, 558-66 (1950) June 1.

This article is an amplified version of a letter to the Editor which appeared in Phys. Rev. 74, 1541-1542(1948) Nov. 15. An abstract of the letter appeared in Nuclear Science Abstracts as Abstract 2-1.

4691 Beta-Spectrum of Ne^{23}. H. Brown and V. Perez-Mendez. Phys. Rev. 78, 812(1950) June 15 (Letter to the editor).

The half-life of β-active Ne^{23} was determined to be 40.2 ± 0.4 sec. The β-spectrum was analyzed by means of a semi-circular focussing β-spectrometer. The spectrum displays an end point corresponding to an energy of 4.21 $\pm$ 0.015 Mev. It is of the allowed shape down to about 1.2 Mev where it deviates from linearity in the Fermi plot. On subtracting the high energy allowed spectrum, a low energy group of the allowed shape was obtained having an end point corresponding to 1.18 ± 0.04 Mev. The ft values are 8.78×10^4 sec and 6,050 sec for the high and low energy groups, respectively.

4692 Capture of Slow β Electrons in Outer Orbits of Heavy Atoms. D. Ivanenko and V. Lebedev. Zhur. Eksptl. i Teoret. Fiz. 20, 91-2(1950)(Letter to the editor, in Russian).

Recent studies of the spectra of soft β particles (Lecoin et al, Compt. rend. 217, 106(1943); ibid. 227, 121(1948)) have shown that the value of the decay probability, as measured directly from the decrease of activity, differs considerably from the value obtained from recurrence formulas for the members of the radioactive family in equilibrium. Several authors (Daudel et al, Compt. rend. 224, 1427(1947); ibid. 225, 290(1947); J. phys. radium 8, 238(1947); Sherk, Phys. Rev. 75, 789(1949)) have attributed this effect to a new type of β decay, which is a "K-creation" or an immediate capture of the electron into one of the atomic levels of the discrete spectrum. However, such a process could hardly affect the probability of the decay by more than a few per cent, because of the almost total orthogonality of the wave functions of the electrons in the shells of heavy nuclei Z and Z+1. An attempt is made here to explain the phenomenon in question by a different mechanism, viz., by a capture of an already emitted β particle into an outer shell of an atom, this process being accompanied by an emission of a photon.

4693 The Fine Structure of the 1414-kev Line and the Problem of the Multipolarity of Its Components. G. D. Latyshev, L. A. Sliv, I. F. Barchuck, and A. A. Bashilov. Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 13, 340-6(1949)(in Russian).

Ellis and Aston (Proc. Roy. Soc. (London) 129A, 180(1930)) have found that the internal-conversion line 1414 kev of RaC' (Po^{214}) has no counterpart in the γ spectrum. Fowler (ibid, 1 (1930)) interpreted the 1414-kev nuclear transition as a 0-0 transition, in which the initial and the final total moments of the nucleus are zero and the process involves either projections of electrons from outer shells or pair creations, without any γ radiation. The present authors obtained recently a conversion spectrum of RaC' which shows a fine structure of the lines K, L, and M of the 1414-kev transition: the peak K has 18 indentations corresponding to two series of nine lines 6 kev distant from each other, the distance between corresponding lines of the two series being 2.5 kev; peaks L and M show similar indentations. The ratios between the conversion probabilities are $W_K/W_L/W_{M+N+\cdots} = 5.4/1/0.33$, and $W_K/W_p = 440$, where W_p is the probability of the formation of pairs. These results are in good agreement with values calculated by using formulas given by the theory of the 0-0 transition (Sakharov, thesis, 1948, in Russian; Yukawa and Sakata, Proc. Phys. Math. Soc. Japan 17, 306 (1935)); on the other hand, there is a disagreement with theoretical values obtained for transitions that involve conversions (or pair creation) and radiations of various multipolarity (electric and magnetic dipoles or quadrupoles). It is difficult to explain, so far, the large number (18) of close levels revealed by the fine structure; something similar has been observed in other transitions of RaC' (1760, 2200 kev) by Geĭ et al (Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 12, 729 (1948)).

4694 Fine Structure of the Magnetic Alpha Spectrum of Plutonium 239. Salomon Rosenblum, Manuel Valadares, and Betrand Goldschmidt. Compt. rend. 230, 638-40(1950) Feb. 13 (in French).

This paper presents a preliminary report of the results of an investigation of the magnetic α spectrum of plutonium-239, carried out at the Laboratoire de l'Aimant-Permanent, with the aid of a magnetic focussing spectrometer (Rosenblum, Nucleonics 4, 38(1949)). The authors describe the method used to prepare pure plutonium sources. A spectrograph obtained with one of the sources is reproduced. This

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spectrum consists essentially of two strong groups, separated by 50 kev. Other weaker groups also seem to be present. The curve resembles spectra of disintegrations for which the spin difference between the final and initial nuclei is zero. The energy of the strongest group is estimated to be 5147 kev, in good agreement with the previously reported results (Jesse and Forstat, Phys. Rev. 73, 926(1948)).

4695 H^3 and the Neutrino Mass. H. A. Tolhoek. Nederland. Tijdschr. Natuurk. 15, 96-9(1949) Apr. (in Dutch).

This is a review of recent work on the subject, pointing out the convenience of H^3 for measuring the neutrino mass owing to the low energy of its β spectrum. The determination is based on Fermi's theory of the β radioactivity.

4696 The L Spectra and γ-Emission in the Radium D-Radium E Transmutation. Lidia Salgueiro and Manuel Valadares. Portugaliae Phys. 3, 21-8(1949) (in French).

A Bragg spectrograph is used to study the x-ray spectrum of the $Pb^{210} \rightarrow Bi^{210}$ reaction. Good agreement is found with the wavelengths of Frilley and Tsien, but discrepancies in intensity are noted and discussed. Five lines have been observed at 1315, 1400, 1550, 1690, and 1755 XU. Of these, the line 1690 has been previously reported by Tsien and Marty from cloud-chamber and absorption data.

4697 On the Calculation of the probability of Decay of a Nucleus by Electron Capture. Pierrette Benoist-Gueutal. Compt. rend. 230, 624-6(1950) Feb. 13 (in French).

It is noted that, when a peripheral electron is captured by a nucleus, the remaining peripheral electrons may change their states. The author sets up a matrix element for electron capture with a different initial and final electronic configuration for the remaining electrons, and calculates this matrix element for the decay, by electron capture, of Be^7 into the ground state of Li^7. The peripheral wave functions are calculated by the Hartree method. The transition probability turns out to be about twice as great as the commonly accepted expression. The probability of electron capture, considered in this way, is no longer proportional to the electronic density at the nucleus. The necessary corrections become negligible for high atomic numbers.

4698 On the Disintegration of C^{14}. Robert Bouchez. Compt. rend. 230, 440-2(1950) Jan. 30 (in French).

The ft value for the disintegration of C^{14} indicates a second order forbidden transition. On the other hand, it appears that this transition corresponds to a change in J of one unit, and the transition should therefore be permitted if one accepts the Gamow-Teller selection rules. The author shows that these difficulties may be cleared up by the following assumptions: The isobars C^{14} and N^{17} contain two nucleons starting a 2p sub-shell, the other nucleons forming a closed shell. Relativistic corrections and noncentral interactions are neglected. C^{14} would then be in a $^1S_0$ state, N^{17} in a $^3D_1$ state. On the basis of these assumptions, the spectrum turns out to be very similar to the permitted type and the calculated half-life is very close to the observed period. The general procedure used by the author may be used to deduce very precise selection rules, but requires a fairly detailed knowledge of the nuclear structure.

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4699 On the Internal Conversion Radiation of Rd Th. Georgette Albouy and Jean Teillac. Compt. rend. 230, 945-7(1950) Mar. 6 (in French).

Previous studies of the γ and internal conversion radiation of Rd Th [Th^{228}] indicate that 9 disintegrations out of 100 leave the final nucleus in an excited state. However, the fine structure of the Rd Th γ spectrum would seem to indicate that 28% of the disintegrations leave the final nucleus in an excited state. The authors have investigated the conversion spectrum with the aid of electron-sensitive photographic plates immersed for an hour and a half in a solution containing purified Rd Th. The distribution of the lengths of α tracks, and of the lengths of electron tracks having common origins with the α tracks, is plotted. These plots confirm the previously reported results; the authors believe that the intensity of the L spectrum is much greater than the value estimated from the number of conversion electrons.

4700 The Peculiarities of the Positron Decay. M. A. Levitskaya and L. P. Rapoport. Doklady Akad. Nauk S.S.S.R. 70, 817-20(1950)(in Russian).

One of the authors (Levitskaya, Doklady Akad. Nauk S.S.S.R. 61, No. 1 (1948)) has demonstrated the presence of "special zones" in the periodic table, which are correlated with certain peculiarities of the β^- decay. This study is extended here to the β^+ decay and the K capture. If half-life periods of positron emitters are plotted against Z, the diagram shows that short periods favor the "special zones." If, on such a diagram, a curve is drawn so as to connect successively those points that correspond to positron emitters differing from the closest stable isotope by only one neutron, it is found that the resultant curve's minima are located in the middle parts of the special zones. The diagram shows also that, among several isotopes, the one closest to the first stable isotope has the longest half-life period; exceptions from this rule concern odd-Z elements having only two stable isotopes: as the author has pointed out, such elements reveal the presence in the periodic table of two parallel branches of nuclear evolution. A similar study of K captures shows that here maximal half-lives occupy the middle parts of the special zones; together with the fact that in these middle parts the energy of the K level is at its lowest values, the above rule seems to confirm the authors view that in these regions nuclei undergo structural changes. No correlations were found between the special zones and the changes in the value of the product τf of Fermi's theory.

4701 Relation between Apparent Shapes of Monoenergetic Conversion Lines and Continuous Beta-Spectra in a Magnetic Spectrometer. II. George E. Owen and Henry Primakoff. Rev. Sci. Instruments 21, 447-50 (1950) May.

The method worked out previously (Rev. Sci. Instruments 20, 768(1949)) for correcting distortions which affect the apparent shape of a continuous β spectrum has been further extended. A general solution of the integral equation governing the relation between the true and the observed spectra is given, and is applied to the correction of the experimental spectra from a 1-mg/cm^2 source of Cu^{64}. The kernel of the distortion integral equation is determined from a study of the internal conversion lines of I^{131} (47 and 330 kev) using sources of various thicknesses from 0.042 to 0.840 mg/cm^2. It is found that the discrepancy between the experimental

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Cu^{64} negatron and positron spectra and those predicted by the Fermi ("allowed") theory can be completely understood as a thick source effect. (auth)

4702 Study of the Gamma Radiation of Mo^{99} in Equilibrium with Tc^{99}. Nadine Marty. Compt. rend. 230, 1270-2 (1950) Mar. 27 (in French).

Mo^{99}, either in its ground state or in an excited state with a half-life of 6.6 hr, disintegrates by β emission into Tc^{99}. Tc^{99} then disintegrates by β emission, with a very long half-life. The authors have studied the γ radiation emitted by these elements, and have determined the energies of the gammas by investigating the Compton electrons which they produce, and the photo-electrons which they eject from various absorbers. They conclude that Mo^{99} in equilibrium with Tc^{99} emits photons with energies of 138, 740, 782, and 845 kev, the last two photons having very low intensity compared to the others.

4703 The Angular Momentum of the Electron in Classical Electrodynamics. F. A. Kaempffer. Can. J. Research 28, 336-8(1950) May.

By postulating the existence of a magnetic dipole at the center of the surface-charged sphere model of the electron, it is shown that not only the rest-mass of the electron but its spin as well is carried by the surrounding electromagnetic field. The ratio of magnetic moment and angular momentum (g-factor) of the electron is determined. The law of conservation of angular momentum is checked. (auth)

4704 The Charge Conjugate Operators of the Electron Theory of Dirac. Jean G. Valatin. Compt. rend. 230, 822-3(1950) Feb. 27 (in French).

The charge conjugate of an operator in the Dirac theory may be obtained by a unitary transformation applied to the complex conjugate of the operator. The form of the matrices used in this transformation depends on the matrix representation of the anticommuting operators γ appearing in the Dirac equation. However, if the operator is written as a function of i, x, $\partial/\partial x$, and of the gammas, the charge conjugate of the operator may be obtained immediately and independently of the matrix representation used in the Dirac equation. The author also shows that any operator may be written as a sum of products of the operator with the projection operators, and with the aid of such an expansion he obtains the relations between the matrix elements of an operator and the elements of its charge conjugate. The operator then is written as a sum of two parts, one equal to its charge conjugate, and one equal to the negative of its charge conjugate. The properties of these components are studied, and it is noted that this analysis into components is significant in comparing the operators of the one particle theory and the positron theory.

4705 The Coupling of Spinor Variables in a System of Dirac Electrons. Jean G. Valatin. J. phys. radium 11, 97-101(1950) Feb.

From the Dirac matrices for one electron the author constructs a set of operators characterizing the coupling of the spinor variables of a system of Dirac electrons. These operators are determined with the aid of the theory of representations of the group of rotations in spaces of four, five, and six dimensions. The eigenvalues of the operator M^2 of

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the square of the magnetic moment of a system of electrons are: $2\{M_+(M_+ + 1) + M_-(M_- + 1)\} - S(S + 1)$, where M_+, M_- and S are integers or half integers.

4706 Fermi Statistics in the Relativity Theory. K. Szél. Hung. Acta Physiol. 1, 19-27(1949)(in German).

The degenerate ideal gas is treated. The method, unlike the earlier treatment by Jüttner (Z. Physik 47, 542(1928)), is not limited to the case of weak degeneracy.

4707 Field and Charge Measurements in Quantum Electrodynamics. N. Bohr and L. Rosenfeld. Phys. Rev. 78, 794-8(1950) June 15.

A survey is given of the problem of measurability in quantum electrodynamics, and it is shown that it is possible in principle, by use of idealized measuring arrangements, to achieve full conformity with the interpretation of the formalism as regards the determination of field and charge quantities. (auth)

4708 The Fundamental Relations of the New Physics. A Simple Formulation. R. Seeliger. Leipzig, J. A. Barth, 1948. 55p. (in German).

In this booklet, which attempts to set forth the fundamental ideas and formulas of quantum theory in the simplest and most logical manner, the treatment differs somewhat from that employed in the standard textbooks.

4709 The Interaction Representation in the Quantum Theory of Fields. J. S. de Wet. Proc. Roy. Soc. (London) 201A, 284-96(1950) Mar. 22.

The interaction representation has recently been introduced into the quantum theory of fields by Tomonaga and Schwinger. Applications of the theory to interacting meson-photon fields have led to apparent difficulties in determining invariant interaction Hamiltonians. Another troublesome feature is the necessity of verifying the integrability conditions of the so-called generalized Schroedinger equation. In the present paper the theory of the interaction representation is presented from a different point of view. It is shown that if two field operators with the same transformation character satisfy two different field equations, there is a unique unitary transformation connecting the field variables on any space-like surface given such a correspondence on one given space-like surface. A differential equation for determining this unique unitary transformation is found which is the analogue of Tomonaga's generalized Schroedinger equation. This gives directly and simply an invariant interaction Hamiltonian and renders unnecessary the explicit verification of the integrability of the Schroedinger equation, since this is known to have a unique solution. To illustrate the simplification introduced by the present theory, the interaction Hamiltonian for the interacting scalar meson-photon fields is calculated. The result is the same as that obtained by Kanesawa and Tomonaga, but it is obtained by a straightforward calculation without the need to add terms to make the Hamiltonian an invariant. (auth)

4710 A Note on Commutators in Quantized Field Theories. S. Schweber. Phys. Rev. 78, 613-14(1950) June 1.

It is shown that the commutators of quantized field theories are not uniquely determined by the specification of the Hamil-

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tonian and the field equations and the requirement of Lorentz invariance. However, this lack of uniqueness cannot be used to obtain a high frequency cut-off as in the nonrelativistic case. (auth)

4711 On the Diagonalizing of the Hamiltonian in the Theory of the Wave Fields. B. Ferretti. Nouvo cimento 7, 79-81(1950)(Letter to the editor, in Italian).

Developing certain ideas of Feynman, Dyson (Phys. Rev. 75, 486 and 1736(1949)) has recently introduced into the covariant quantum electrodynamics of Tomonaga and Schwinger an operator $S(\sigma)$ depending on the space hypersurface σ; this operator is a generalization of Heisenberg's matrix S which coincides with the operator $S(\infty)$ of Dyson-Feyman. It is shown in the present note that the operator $S(\sigma)$ can be regarded as an operator generating a canonical transformation which, under certain conditions, diagonalizes the Hamiltonian of the two interacting wave fields (matter and radiation).

4712 On Forced Oscillations in Quantum Mechanics. M. M. Al'perin. Zhur. Eksptl. i Teoret. Fiz. 20, 62-4 (1950)(in Russian).

The problem of forced oscillations in an one-dimensional oscillator is examined quantum-mechanically, by discussing the question of the energy supply to the oscillator from an outer system. (auth)

4713 On a Geometrical Interpretation of Energy and Momentum Conservation in Atomic Collisions and Disintegration Processes. J. Blaton. Matematisk-Fysiske Meddelelser 24, No. 20, 1-30(1950).

This paper deals with the relations that can be derived from the conservation laws for energy and momentum. The conservation laws are treated in relativistic form. They allow an interpretation by means of a simple geometrical picture from which it is possible, for every collision or disintegration process, to obtain a qualitative and quantitative survey regarding the possible momenta and energies of the particles in the final states.

4714 On the Meson Field Connected with the Electron in the New Theory of the Subtractive Field. Louis de Broglie and René Reulos. Compt. rend. 230, 1009-10 (1950) Mar. 15 (in French).

If it is assumed, in the theory of the subtractive field (Portugaliae Math. 8, 37(1949)), that the electron interacts with two meson fields, the theory leads to the introduction of a meson with mass approximately equal to that of the π meson. Such a conclusion is reached on the basis of fairly simple hypotheses. (auth)

4715 On the Quantization of the Metric Field and the Particle-Field Interactions. II. Application to Magnetic and Nuclear Fields. Antonio Gião. Compt. rend. 230, 434-6(1950) Jan. 30 (in French). (See also NSA 4-2831 and 4-4397.)

The author applies his method of quantization (Compt. rend. 230, 278(1950)) to magnetic and nuclear fields. These fields may be obtained from the matrix elements of the internal and external metric tensors. In order to derive these matrix elements, a quantization procedure is applied to the metric tensors, and the static nuclear potential is calculated.

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The author also calculates the energy of the electromagnetic field due to a nucleon, and the magnetic dipole matrix elements.

4716 On the Quantization of the Metric Field and the Particle-Field Interactions. IV. Application to the Spectrum of Hydrogen. Antonio Giao. Compt. rend. 230, 1838-40(1950) May 22 (in French). (See also NSA 4-2831.)

By introducing into the relativistic equations of the electron the quantized potentials derived in a preceding article (Compt. rend. 230, 278, 434, 1740(1950)), the author shows that the hyperfine structure of the hydrogen spectrum can be attributed to the interaction of the electron with the non-Coulomb proper field of the proton.

4717 On the Quantum Theory of Elementary Particles. W. Heisenberg. Z. Naturforsch. 5a, 251-9(1950) May (in German).

Progress in the quantum theory of fields during the last few years is sufficient to indicate a mathematical system according to which the future theory of elementary particles may possibly be constructed. This system has the following properties: the totality of all elementary particles is represented by a single spinor field. This spinor field satisfies (in the so-called interaction representation) a commutation relation which has a positive sign and is regular in the entire space-time region; moreover, a relativistic invariant (an expression of at least fourth degree in the spinor field) is assumed as interaction energy. These two functions, the commutation function and the interaction energy, completely specify the theory. From them the rest masses of all elementary particles can be calculated in principle, and it is impossible to distinguish clearly between elementary and compound particles. For this reason there occur, in general, elementary particles with integral as well as with half-integral spin values (correspondingly with Bose- or Fermi-statistics); light quanta, too, are to be represented by a spinor field. In the calculation of rest masses or the interaction of elementary particles there occur no divergent expressions because of the regularity of the commutation relation, and the entire theory is just as regular as ordinary nonrelativistic quantum mechanics. These properties appear to the author as a strong argument in favor of the assumption that a future theory of elementary particles, which could then be called a "unitary field theory," will be constructed according to a system similar to the one discussed.

4718 On the Scattering of Electromagnetic Waves by Free Electrons. I. Classical Theory. N. D. Sengupta. Bull. Calcutta Math. Soc. 41, 187-98(1949) Dec.

The relativistic form of the Lorentz equation of motion of the electron is solved completely. Scattering is then determined from the Lienard-Wiechert potential corresponding to the electron velocity. The scattered radiation differs in frequency from the incident radiation; the difference is calculated. The frequencies of the scattered radiation are integral multiples of a basic frequency.

4719 On Weiss's Theory of Fields. T. S. Chang. Chinese J. Phys. 7, 265-77(1949) Apr.

The author gives a generalized formulation of the theory of Weiss (Proc. Roy. Soc. (London) 156A, 192(1936)) dealing

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with the change of a Schroedinger wave functional on a surface as the surface changes, by allowing the Legrangian of the field to contain all derivatives of the field quantities. The integrability of the resulting equation is proved by making use of the fact that the corresponding Hamilton-Jacobi equation is integrable. This gives at the same time a proof of the Lorentz invariance of the commutation relations between the various conjugate variables, which so far had been obscure when derivatives of the field quantities of higher order than 2 were allowed to appear in the Lagrangian.

4720 Photo-Disintegration of the Deuteron at High Energies. J. F. Marshall and E. Guth. Phys. Rev. 78, 738-44(1950) June 15. (See also NSA 4-1218, 4-1223.)

Total cross sections and angular distributions for the photodisintegration of the deuteron for energies between 10 and 150 Mev are computed for various types of central neutron-proton interactions. Most of the explicit computations are carried out for the case of 50% ordinary and 50% exchange interactions. Neutron-proton interactions considered are of the square well, Yukawa, and exponential types with two effective ranges. Theoretical analysis of the experimental data on high energy neutron-proton scattering excludes the square well, but is compatible with both Yukawa and exponential types of potentials. The Yukawa potential is replaced by an equivalent Hulthén potential. For the square-well and exponential potentials explicit analytic solutions were obtained. The treatment of the case of the exponential potential is rigorous and at the same time almost as simple as that of the Hulthén potential. A qualitative discussion of the photoelectric dipole transition is given on the basis of the f-sum rule. This shows how exchange forces greatly increase the cross section at high energies. The discussion can be carried out for any exchange ratio. It is pointed out that only the photoelectric dipole and quadrupole cross sections can be obtained independently of specific meson theories of nuclear forces. The results for photodisintegration show a pattern similar to those on neutron-proton scattering: very little difference between Yukawa and exponential potentials, somewhat larger difference between these two and the square-well potential. There is a pronounced dependence on effective range. In the appendix a simple derivation of the dipole cross section for the ordinary square well potential is given, based on a transformation involving the equations of motion. (auth)

4721 The Quantum Mechanics of Localizable Dynamical Systems. T. S. Chang. Phys. Rev. 78, 592-6(1950) June 1.

Expressions for the operators in Dirac's general theory of quantum mechanics of localizable dynamical systems are explicitly constructed and their commutation laws directly worked out. Conditions for the expectation values of dynamical variables or their densities to be independent of the parametrization of the surface are given and it is shown that of the two conjugate field variables in Weiss' theory (Proc. Roy. Soc. A156, 192(1936)), one is a parametrization-independent variable and the other is a parametrization-independent density. Finally it is shown that P^n in Dirac's theory (Phys. Rev. 73, 1092(1948)) does not have any simple expression other than that given in Weiss' theory. These results indicate that Weiss' and Dirac's theories are equivalent. (auth)

4722 The Relation between the Operators of the Single Particle Theory and Those of the Positron Theory. Jean G. Valatin. Compt. rend. 230, 925-7(1950) Mar. 6 (in French).

The author writes the operator of the positron as a sum of four terms, each term representing the operator taken between one of the four combinations of initial and final positive and negative energy states. He states, taking the kinetic energy operator of the single particle theory as an example, that operators do not necessarily have the same physical interpretation in the two theories. It is then shown that operators in the single particle theory which are equal to their charge conjugate correspond to positron theory operators which change their sign with the charge, while those which are equal to the negative of their charge conjugate correspond to positron operators independent of the sign of the charge. The author also derives a relation between those operators in the two theories which commute with the number of particles.

4723 Remarks on an Article by R. P. Feynman. Antoine Visconti. Compt. rend. 230, 928-9(1950) Mar. 6 (in French).

An essential point in Feynman's recent article on positron theory (Phys. Rev. 76, 754(1949)) is the representation of the wave function of an electron at one point in space-time as the volume integral of the product of a kernel with the wave function at another point in space-time. The author considers this integral as the solution of the Dirichlet problem as applied to the Dirac equation. He then discusses certain problems involved in the rigorous solution of this problem, and raises several questions touching on the validity of Feynman's integral representation.

4724 Unified Field Theory in Six Dimensions. J. Podolanski. Proc. Roy. Soc. (London) 201A, 234-60 (1950) Mar. 22.

It is pointed out that the geometry of the Dirac equation is actually six-dimensional. Taking this hint it is shown that a six-dimensional - classical - field theory avoids the difficulties with which the Kaluza-Klein theory has to contend. Moreover, the possibility is gained of making the field energy of a point source finite. A geometric requirement (structure axiom) decomposes the six-dimensional continuum. The space-time world appears as a subspace, immersed in the six-dimensional space. Each world point corresponds to a sheet of physically indistinguishable points. Potentials and gauge transformation can be interpreted geometrically. As a consequence of the embedding, two fields of inertial forces (fields of constraint) occur. The one behaves just as the Maxwell field; the other has negative energy and can cancel the singularities of the electromagnetic one. The theory can be made conformally invariant and then yields a relation between the mass and the charges (the sources of the constraining fields). The presentation given in this paper is provisional, as it gives infinite range also to the field of negative energy. (auth)

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4725 The Use of Radio Elements in the Study of Transition Temperatures and Critical Temperatures of Molecular Jets on Surfaces. Gustave Ribaud and Marcel Devienne. Compt. rend. 230, 1811-12(1950) May 22 (in French).

Using a jet of radioantimony ($Sb^{122,124}$) the authors were able to detect its deposition on a glass surface within ½ hr, while a deposit of stable antimony could not be detected after 10 hr. A slight modification using copper plates with a circular orifice in the path of the beam was used for the detection of the reflected jet.

4726 Velocity of Phosphorus Exchange in Nucleoproteins of Digestive Glands. M. A. Guberniev and L. I. Il'ina. Doklady Akad. Nauk S.S.S.R. 71, 351-3(1950) (in Russian).

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With the aid of radioactive P, experiments (on dogs) were made illustrating the accelerated synthesis of nucleic acids in the digestive glands, which takes place when the secretion of these glands is stimulated by pilocarpine. Thus, the specific activity of phosphorus from the nucleoproteins of the parotid gland was five times larger in an animal that had been injected with pilocarpine (1.5 ml 1% solution) than in a control animal; the corresponding values for the pancreas and the liver were 12 and 6. In other experiments measurements were made of the increase in the formation of desoxyribonucleic acid in liver under the influence of bile injected intravenously.